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ABSTRACT

This publication presents an instructional system design (ISD) which is a systematic procedure for assuring the application of planning and organization to vocational programs. The resulting instructional system, according to the author, is an integrated combination of resources, students, instructors, materials, equipment, techniques, and procedures performing effectively and efficiently the functions required to achieve specified learning objectives. This presentation of the ISD breaks the design down into sequential steps grouped into separate chapters titled as follows: Philosophy and Standard Characteristics of Vocational Education, a Foundation for Curriculum Development; Concepts and Practices in Vocational Curriculum Development; Using Surveys and Analyses as a Basis for the Development of a Course Outline; Instructional Objectives; Determining Instructional Program Strategies; Scope and Sequence of Tasks; Grouping and Scheduling for the Instructional Program; Determining the Related Instructional Content; Determining Evaluation Strategies; and Outline of Procedure for the Development of a Course of Study. Each chapter includes definitions of related terms and specific strategies/suggestions for the topical area. Summaries, flow charts, and references are also included in some chapters. A glossary of curriculum terms is appended. (SH)

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AN INSTRUCTIONAL SYSTEM DESIGN FOR VOCATIONAL EDUCATION

By Byrl R. Shoemaker

Edited by

Darrell L. Parks

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Division of Vocational Education

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FOREWORD

The goal of vocational education is to prepare individuals for and assist them to obtain meaningful employment. This may not be vocational education's only goal, but it remains the dominant one—one for which it will be held accountable.

If vocational education is to achieve its goal, it must systematically design an instructional program that is based upon occupational skill and technical knowledge requirements. Additionally, such a system must provide for the appropriate organization of educational resources in order to optimize the efficiency and effectiveness of the teaching-learning process.

This publication presents an Instructional System Design (ISD) which is a systematic procedure for assuring the application of planning and organization to vocational programs. The resulting instructional system is an integrated combination of resources; students, instructors, materials, equipment, techniques and procedures performing effectively and efficiently the functions required to achieve specified learning objectives.

The ISD set forth in this document has been field tested; it will work; and where it has been implemented it has enjoyed enthusiastic endorsement of both instructional and administrative personnel.

Let it be emphasized, however, that the ISD is a system. It will be necessary for each teacher to apply the system to his/her vocational program in order to activate it. Even though the system has universal applicability, it must be individualized to specific teacher, program and environmental characteristics and conditions.

Based upon field test results to date, the utilization of the ISD in course of study development has resulted in improved planning, better instruction and a more highly satisfied and employable student.

Darrell L. Parks
Columbus, Ohio
June, 1976

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AN INSTRUCTIONAL SYSTEM DESIGN

FOR

VOCATIONAL EDUCATION

CHAPTER I

PHILOSOPHY AND STANDARD CHARACTERISTICS OF VOCATIONAL EDUCATION, A FOUNDATION FOR CURRICULUM DEVELOPMENT

Vocational education has expanded dramatically in this nation since the passage of the Vocational Education Act of 1963. The expansion has been marked by a significant growth in physical facilities to serve more people in an ever-broadening scope of vocational education programs. For the most part, the new physical facilities and the equipment selected for those facilities have been in keeping with the needs of a modern technological society for both vocational and technical education. The quantity and scope of the vocational education programs, however, have not been matched by improvements in curriculum development, which has kept pace neither with technological developments in industry and business, nor educational theory and practice.

The large investments in physical facilities, equipment and operation of vocational programs in public education require a like investment in the improvement of the curriculum. The quantitative growth of vocational education is an accomplished fact. The future of vocational education, however, rests with the improvement of programs to match this growth.

A plan for curriculum development within either a state or a local education agency will be affected by the philosophy and standards for vocational education, held by the agency giving leadership to the curriculum development. A philosophy which sees vocational education as having a basic responsibility for preparation of people for employment will provide a different base for curriculum development than a philosophy which views vocational education as basically general education, with its function essentially personal development of the individual rather than preparation for job skills. Obviously, these two hypothetical positions are chosen for their wide difference. A less diametric, but still influential philosophical difference might center on the question whether a vocational program should involve only laboratory experiences, with technical knowledge being gained only incidentally to the accomplishment of the skills, or should instructional time be allotted in addition to the laboratory time in order that technical understandings or cognitive content of related disciplines may be taught. A vocational philosophy provides a basis for determining whether the curriculum development will relate to students enrolled in high school or only to students beyond high school. Some philosophies consider vocational education an integral part of the educational system; others view it as an adjunct to the educational system.

The following statement of philosophy serves as a basis for the curriculum development in process in Ohio:[1]

A PHILOSOPHY FOR VOCATIONAL EDUCATION

1.0 BACKGROUND

1.1 A philosophy of education must provide a reason for the structure and program of education offered and serve as a stimulus for educational change. A philosophy for vocational education must provide answers to such questions as:

1.11 Why should vocational education be offered as a part of the public education effort for youth and adults? What are the social bases, the economic reasons, and the educational factors?

1.12 What should be the nature of the organization, scope and content of vocational education programs?

The overall purpose of education in any society is to prepare people to perpetuate and improve the society in which they live. An educational program must be related to the political, social and economic patterns of the society it serves.

2.0 PHILOSOPHY STATEMENT

2.1 *The nature of work in our technological society requires formal preparation for entrance into the work force. Vocational education, therefore, must be a significant part of the educational system in our society.*

The educational process is constantly affected by the society in which it exists and by the social and economic factors prevailing in that society. Early efforts in education within our nation emphasized the importance of literacy and citizenship training, since a republic depends upon a literate, informed and concerned citizenry.

As our society grew more affluent, more complex, free public education was extended into the high school years. At the time the early high schools were organized, the large majority of youth attending high school did so as a preparation for attending college. Job skills other than the professions were passed on from father to son; learned through apprenticeship or indenture; or picked up on the job.

Today the world of work is more complex. Only 4.7 percent of the jobs within our society require unskilled labor and only 12.6 percent of the jobs require a baccalaureate degree. (2) Thus, over 82 percent of the jobs today require vocational or technical preparation as a price tag for entrance into employment. The nature of the economy and nature of the work have limited opportunities for apprenticeship or learning by the pickup process.

2.2 *Vocational education is essential for and must relate to the productivity of people, not only in competence, but in attitude towards one's occupation and willingness to produce.*

Studies by the Brookings Institute point up an economic base for vocational education within the curriculum.(3) Such studies indicate that, while the United States was number one in growth rate of real output per man-hour for many years, we no longer enjoy that superiority. Such research indicates that the United States is dead last among the developed nations of the world in growth rate of real output per man-hour. Japan is number one, West Germany, number two, and the United States of America, number twenty.(4) Additional studies of the factors relating to growth rate of real output per man-hour indicate that such growth rate is made up of 15 percent machines, 36 percent knowledge related to production, 42 percent education, and seven percent miscellaneous.(3) A synthesis of these factors would show that our competitive capability, therefore, is related to the education of the people. Vocational education is dedicated to improving the productivity of our work force.

2.3 The uniqueness of vocational education, preparation for work, permeates vocational programs at both the high school and post-high school level.

Vocational education cannot be classified as a unique discipline within the educational system. Rather, it can be identified as a program in which we combine the skills and technical content of the various disciplines with the practical skill requirements of the world of work in order to prepare a young person to succeed technically and socially in the world of work. Vocational education, while not unique as a discipline, is unique as a program, and this uniqueness is reflected in facilities and equipment needed for the instructional program, curricula, instructor qualifications, and student goals and services.

Preparation for paid or non-paid employment is the goal of any vocational program. Therefore, the program must contribute to the development of citizenship qualities, work habits and attitudes, safety judgments, understanding of occupational choice, and other factors common to other educational programs. Compatible skills of communication, decision-making, learning to learn, and personal and occupational responsibility are important and equally within the purview of vocational education. These "true salable skills," and the individual's capacity to transfer them regularly and usefully to work and needs throughout life, require that vocational education emphasize them.

Vocational education has an excellent opportunity to instruct in such common learnings. If vocational education programs, however, do not maintain the uniqueness of preparation for work which is not found in any other educational program, it is questionable whether the added costs can be justified for instruction which could be gained in other programs of learning.

2.4 *Vocational education programs must be available at both the high school and post-high school levels and throughout the work life of the individual.*

Instruction within vocational education programs must be compatible with educational theory and principles of learning gained from research in psychology and education.

Decisions relating to the starting point for vocational education must relate to studies on child development and occupational choice. Studies in guidance relating to occupational choice indicate that a young person's occupational choice becomes reasonable at age 16 if he has been educated for choice.(5) Observations not yet substantiated by research suggest that, psychologically, youth becomes goal oriented at age 16, and any mandatory educational program at that age or beyond must relate to such goals. For the majority of youth, high school is their last chance for full-time education. It is also clear that a number of youth want to delay their first opportunity for vocational education until after they leave high school.

The rapid changes in occupations and the needs of adults for retraining and upgrading instruction throughout their work life point up the need for facilities and programs to serve people from age 16 on throughout their work life.

2.5 *The nature and quantity of vocational education must be in keeping with employment patterns and trends locally, state, and nationally, in that order.*

Every set of objectives, including the "seven cardinal principles of education,"(6) "the 10 imperative needs of youth,"(7) developed by a national principals' group, or the "developmental needs of youth,"(8) as identified by Havighurst, all establish the importance of preparing for employment youth who are not going on to college. Education has traditionally focused on a subject-centered college preparatory curriculum at the high school level and subject-centered professional curriculum at the collegiate level. Research pointing to the lack of correlation of success in high school college preparatory programs to success in college raises serious questions about this tradition.(9)

2.6 *Instruction within vocational education must be compatible with findings of research in psychology and education.*

A study of the learning process itself will show that the early philosophers in education, such as Rousseau, Pestalozzi and Froebel, all saw the need for the inclusion of student experiences to prove many of the concepts of the early philosophers. Principles of learning growing out of these psychological studies were stated by Gerald Leighbody as follows:(10)

> We learn best when we are ready to learn. When we have a strong purpose, a well-fixed reason for learning something, it is easier to receive the instruction and to make progress in learning.
>
> The more often we use what we have learned, the better we can perform or understand it.
>
> If the things we have learned are useful and beneficial to us so that we are satisfied with

what we have accomplished, the better we retain what we have learned.

Learning something new is made easier if the learning can be built upon something we already know. It is best to start with simple steps which are related to things we can do now or which we already understand and progress to new and more difficult tasks or ideas.

Learning takes place by doing. Before the learning can become complete, we must put into practice what we are attempting to learn.

The principles for vocational education outlined by Prosser apply learning theory and results of psychological studies on learning to vocational education.(10)

2.7 *Vocational programming requires a time commitment of sufficient length and intensity to provide instruction in the several domains important to a student's successful entrance into and within a chosen occupation.*

Sound vocational education must be concerned with the employability of the student upon completion of the program and with the student's ability to adjust to technical changes within his occupation and the social setting of the occupation. The curriculum for vocational education, therefore, must be concerned with and provide instructional experiences in the psychomotor, cognitive, affective, and perceptive domains. Since the unique role of vocational education is preparation for employment, the physical facilities and equipment, qualifications of the instructional staff, organization of the curriculum and recruitment, enrollment, and placement of students must all reflect the unique role of vocational education as well as a commitment to the common learnings demanded of every educational program. Adequate time must be provided for the learner to gain the skills, technical knowledge, social attitudes and competencies essential for entrance into and progress in employment.

2.8 *An effective vocational education program requires competency in reading, writing, and arithmetic and experiences leading to a sound occupational choice.*

There are no semi-skilled, skilled, or technical occupations which do not require basic literacy in reading, writing, and arithmetic. If such skills are not present when a student enrolls in a vocational program, they must be taught concurrently with the skills of an occupation.

Most individuals can succeed in several different occupations. Each person, therefore, must be provided experiences prior to enrollment in vocational education which motivate him to want to work and to respect all work; orient him to the various semi-skilled, skilled, technical, and professional occupations available in the work force; and give him the opportunity to explore selected occupations to determine his interests and capabilities.

3.0 SUMMARY

3.1 *Vocational education programs based upon these principles must be provided for all eligible age levels, all ability levels, in all sections of a state and the nation. Programs must be occupationally based and designed to meet the needs of both the individual and the society in which he exists. Vocational education starts with the job and ends with the student successfully employed on the job.*

A statement of standard characteristics for vocational education is an inherent part of the philosophy and definition of vocational education. Standard characteristics should be:

-an outgrowth of a philosophy of vocational education,
-consistent with the role of vocational education,
-a corporate part of the governance of vocational education, and
-supportive to the definition of vocational education.

Thus, the standard characteristics of vocational education by necessity reflect and relate to a philosophy and definition. Furthermore, the term *standard characteristics* relates to distinguishing traits or features of vocational education which are essential to its purpose, and which may or may not be consistent with individual educational disciplines.

Standard characteristics of vocational education can be viewed from a perspective common to both state and local levels of program administration and operation. Admittedly, selected characteristics may have slightly different interpretations depending on the program level. However, the following proposed characteristics are inherent to sound program management and effective services to youth and adults regardless of the level of operation:(11)

STANDARD CHARACTERISTICS OF VOCATIONAL EDUCATION

1.0 STANDARD CHARACTERISTICS

1.1 Philosophical and Educational Foundation

Initially, a program of vocational education must be founded upon a sound philosophical and educational base. Without such a base upon which to build, the program will have neither stability nor direction.

The program philosophy should reflect the fundamental purpose of vocational education and its place in the social, economic, and educational environments. Specifically, the philosophy should address two fundamental questions:

a. *Why* vocational education in lieu of or in conjunction with other educational concepts?
b. *How* does vocational education meet current and projected social, economic, and individual needs?

The educational program should be a core curriculum aimed at preparing individuals for employment. Such a vocational education base must embrace the principles of learning which emphasize the effective use and application of knowledge taught.

The philosophical and educational foundation for vocational education can be strengthened by a state leadership point of view. However, such a foundation must be subscribed to or adjusted at the local level if it is to be effective.

Subsequent to the formulating of a philosophical and educational base, it is necessary to structure and implement an effective delivery system for vocational education. Such a delivery system must possess a set of standard characteristics if the state educational agency (SEA) and the local educational agencies (LEA) are to fulfill their respective leadership roles in program development, implementation, and administration.

1.2 Constituency Support

Although treated as a separate entity, building program constituency is dependent upon and closely allied with program philosophy, quality, and outcomes. However, the importance of program constituency merits discussing it independently.

Constituency support does not come about automatically, but must be cultivated and nurtured at all program levels if vocational education is to prosper and grow. Vocational education is a service effort for both the individual and business and industry. Close relationships must be developed and maintained with persons who need vocational education and agencies who employ its graduates in order to assure currency and relevance. Vocational education functions

within and as a part of the social and economic environment. Community involvement and input must be sought and taken into account if public support is to continue. There must be laws and regulations and financial support for vocational education if it is to reach its potential in services to our society. Finally, vocational education must be packaged in such a manner that it appeals to the needs and interests of a significant segment of the student clientele.

Ultimately, the goal of building a constituency is to attain the degree of commitment and support for vocational education that will assure its prominence and permanence on the educational scene. *Thus, each program level and, in fact, each individual program offering must identify and effectively utilize its appropriate constituency.*

1.3 Program Planning

It is the responsibility of the SEA to establish an adequate program of vocational education for all people in all parts of the state. In order to fulfill such a responsibility, careful and detailed planning on a statewide basis is essential. Such planning must be based upon a set of statewide goals and measurable program objectives and the effective utilization of valid regional or statewide data and information.

Once developed, the state plan for vocational education must be translated into LEA level plans of action. SEA and LEA plans of action will have to be compatible. *Hence, a standard characteristic of vocational education at all levels should be a carefully developed and documented plan that is based upon a set of specific goals and measurable program objectives and which will facilitate and support subsequent planning and programming efforts.*

1.4 Program Development and Expansion

Like most social movements supported and financed via local, state and federal taxes, vocational education must compete for the limited tax dollar. Based on the assumption that vocational education needs exceed available revenue, it is essential that optimal use be made of available dollars. This necessitates a carefully derived pattern for program development and expansion. *Thus, a fourth standard characteristic of vocational education should be the existence of a comprehensive pattern for program development and expansion, supported by legislation and fiscal commitments at the state and local levels, and taking into account occupational needs, student base, and educational resources available or required.*

1.5 Program Standards

In order to provide the quality of services needed by students and employers and to assure an effective use of fiscal and educational resources throughout the state, it is essential that vocational education programs be built around and maintained upon a set of appropriate program standards. These standards should address the "four factors of production" of vocational education: curriculum, facilities and equipment, instructional staff, and students. *Consequently,*

a fifth standard characteristic of vocational education standards should be addressed to the "four factors of production," that contribute to and enhance the quality of instruction. Such standards must be accompanied by appropriate mechanisms for monitoring and enforcing them.

1.6 Personnel Development

Regardless of the soundness of the program philosophy, the comprehensiveness of goals and objectives, or the appropriateness of program standards, the degree to which vocational education is effective is largely dependent upon the availability of quality state and local leadership and occupationally competent instructional personnel. An adequate supply of competent personnel is too important to leave to chance. *Thus, a sixth standard characteristic of vocational education should be a well defined and operative program of professional personnel development which assures an adequate supply of leadership and occupationally competent instructional personnel imbued with both the technical and pedagogical skills and understandings essential to program development and operation.*

1.7 Program Evaluation

Program review and evaluation are key ingredients to any program's success. Program review in vocational education should embrace two dimensions: process and product evaluation.

Process evaluation is formative in nature, and its primary purpose should be the improvement, development, and expansion of vocational education. This evaluative component assures the effectiveness of the program variables of curriculum, facilities and equipment, instructional staff, and students. Comprehensive evaluation measures of a formative nature should provide for an extensive self-review of programs at the operational level, involving representation from business, industry, parents, and students, as well as an external assessment from an SEA perspective.

The degree of success and support enjoyed by vocational education will be largely dependent upon the number of students who obtain full-time employment and who perform satisfactorily on the job. Student placement and follow-up is essentially a product or summative evaluation component and is the accountability measure for vocational education. Placement and follow-up evaluation are primarily LEA responsibilities and not only reflect the quality of the educational program, but also assess the soundness of the philosophical and educational base upon which the program has been built.

A basic standard characteristic of vocational education is a mechanism which provides for periodic formative and summative program evaluation. It is desirable that such a review process includes an LEA self-review and an external review from the SEA level. The evaluation mechanism should also provide a means for review follow-up and program redirection. Placement and follow-up of graduates, however, is the ultimate test of vocational education services.

2.0 SUMMARY

Standard characteristics of vocational education must be an outgrowth of a philosophical foundation. Once the standard characteristics have been determined, operational criteria must be established for each standard characteristic. The establishing of such criteria must once again evolve from and relate to the program philosophy.

The goal statements called for in the standard characteristics have been established for Ohio, based upon the concepts of management by objectives. Also, the program standards and operational criteria called for in the standard characteristics are present as a basis for program organization and operation. Program standards and criteria in Ohio provide a basis for approval of programs of various length and depth. It is possible under program standards in Ohio to offer a program limited in both length and depth at either the high school or post-high school level. The curriculum development pattern reviewed in this document, however, will relate to a program of sufficient length and depth to provide for adequate development of the cognitive, psychomotor, and affective learning essential to prepare a youth or adult for entry into employment in a chosen occupation requiring significant skills and technical knowledge.

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CHAPTER II

CONCEPTS AND PRACTICES IN VOCATIONAL CURRICULUM DEVELOPMENT

"Curriculum for Vocational Education Starts with a Job and Ends with the Student on the Job"

As stated in the first chapter, vocational education cannot be classed as a unique discipline within the educational system of our country. Rather, it can be identified as a unique program which combines the skills and technical content of various disciplines with the practical requirements of the world of work in order to prepare a young person to succeed technically and socially. Vocational education, while not unique as a discipline, is unique as a program, and this uniqueness is reflected in facilities needed for the instructional program, equipment, instructor qualifications, student goals, and curriculum. Within this listing of unique factors for vocational education, the student goals become paramount and serve as the basis for the development of the curriculum, facilities, and equipment. Also, instructor qualifications grow out of the curriculum plan.

This section will focus on problems in and concepts of curriculum development. Each area of vocational education has a uniqueness in content which makes some differences in the pattern of organizing and reporting the curriculum process. It is more important, however, to discuss some general concepts and theories which serve as a basis for decisions about curriculum.

Many of the arguments over curriculum organization, curriculum material development, and the amount of emphasis to be placed upon vocational education curricula within the public education process grow out of differences in understanding or lack of understanding of principles in learning theory or the educational process. Disagreements over curriculum often start in differences in opinion over:

the purpose of education
learning theory and principles of learning
attitude towards present collegiate preparatory curriculum
principles of curriculum organization
scope of curriculum.

Any approach to curriculum development will be shallow unless a review is made of these factors and some principles of education developed.

Purpose of Education

The philosophy set forth in the first chapter stated that the overall purpose of education in any society was "to prepare people to adjust to and improve the society in which they exist." The changing nature of our society, which is reflected in changes in the educational system, also was identified in that statement of philosophy. It is obvious, however, that our educational system has not kept pace with the development of either society or educational theory. The subject organization and the professional goal orientation of the colleges and universities became the curriculum organization for our high schools with no other basis in theory than that "this is the way we do it in college." As the junior high school was organized, the theory was to break away from the subject orientation of the high school and to establish a more experience-centered program at the junior high school level. The junior high schools, however, tended to become "junior" high schools, carrying the sins of the subject-centered orientation of the colleges down one more step to the youth in the seventh, eighth and ninth grades. Over the years, the high schools adopted a Carnegie unit of credit, which allowed the colleges and universities to identify those students who had completed the course of studies which each college assumed was the best one to prepare for the education it would offer. The yoke of the Carnegie unit concept still hangs around the neck of our public school system, not so much because of its continuing requirement by the collegiate level, but because that's the way we've always done it and we don't know what else to do if we deviate from that pattern. The weighty yoke of the historical subject-centered curriculum and the set-in-concrete base of the Carnegie unit have tended to obscure any purpose of education which does not continuously measure the intelligence quotient of a student through his performance in the "four sound subjects." The obscurity of the organization of the present curriculum and the fact that most intelligent students have tended to do well in the college preparatory curriculum have grossly misled the public into assuming that the subject-centered curriculum was the best way to prepare for life.

The present subject-centered college curriculum assumes

that preparation for work cannot prepare for living and citizenship as well as for earning a living.

that liberal arts, which tend to contribute to enjoyment of living, take precedence over preparation for employment.

that most of the youth participating in our public education system, including the large number that drop out from the system, can continue to get training for work through the pickup method.

Another thesis suggests that

> the price of our technological age is pre-employment training for the majority of youth who wish to enter employment in business and industry.
>
> curricula planned for pre-employment training can also make a major contribution to the development of good work habits and attitudes and the education of youth as participating citizens in our form of government.
>
> curriculum planned at the high school level cannot assume the role of education for a lifetime.
>
> while both cultural subjects and occupational training are worthy services of education, the opportunity to participate in the cultural values offered in our society is dependent upon employment in that society.

Learning Theory and Principles of Learning

Chapter I pointed toward the importance of experience as a base for education both in the theories of early philosophers and in later psychological studies of how people learn. The educational programs of today continue, essentially, to ignore both learning theory and principles of learning. Any curriculum pattern, however, which is not based upon proven learning theory is doomed to failure or will at best serve as a paper structure to satisfy policies of a school administrator. John Dewey, a modern theoretician in education, made popular the phrase "learning by doing." Although Charles Prosser, an early philosopher in education, and John Dewey were reported to be antagonists in the field of education, Prosser's Sixteen Theorems for Vocational Education, so well known to the people within vocational education and as applicable today as when they were written, put into language for vocational educators the proven principles of learning and the educational theories so well expressed for all of education by John Dewey.

PROSSER'S SIXTEEN THEOREMS ON VOCATIONAL EDUCATION[1]

A Basis for Vocational Philosophy

1. Vocational education will be efficient in proportion as the environment in which the learner is trained in a replica of the environment in which he must subsequently work.

2. Effective vocational training can only be given where the training jobs are carried on in the same way with the same operations, the same tools and the same machines as in the occupation itself.

3. Vocational education will be effective in proportion as it trains the individual directly and specifically in the thinking habits and the manipulative habits required in the occupation itself.

4. Vocational education will be effective in proportion as it enables each individual to capitalize his interest, aptitudes, and intrinsic intelligence to the highest possible degree.

5. Effective vocational training for any profession, calling, trade occupation or job can only be given to the selected group of individuals who need it, want and are able to profit by it.

6. Vocational training will be effective in proportion as the specific training experiences for forming right habits of doing and thinking are repeated to the point that the habits developed are those of the finished skills necessary for gainful employment.

7. Vocational education will be effective in proportion as the instructor has had successful experience in the application of skills and knowledge to the operations and processes he undertakes to teach.

8. For every occupation there is a minimum of productive ability which an individual must possess in order to secure or retain employment in that occupation. If vocational education is not carried to that point with that individual, it is neither personally nor socially effective.

9. Vocational education must recognize conditions as they are and must train individuals to meet the demands of the "market" even though it may be true that more efficient ways of conducting the occupation may be known and that better working conditions are highly desirable.

10. The effective establishment of process habits in any learner will be secured in proportion as the training is given on actual jobs and not on exercises or pseudo jobs.

11. The only reliable source of content for specific training in an occupation is in the experiences of masters of that occupation.

12. For every occupation there is a body of content which is peculiar to that occupation and which practically has no functioning value in any other occupation.

13. Vocational education will render efficient social service in proportion as it meets the specific training needs of any group at the time that they need it and in such

a way that they can most effectively profit by the instruction.

14. Vocational education will be socially efficient in proportion as in its methods of instruction and its personal relations with learners it takes into consideration the particular characteristics of any particular group which it serves.

15. The administration of vocational education will be efficient in proportion as it is elastic and fluid rather than rigid and standardized.

16. While every reasonable effort should be made to reduce per capita cost, there is a minimum below which effective vocational education cannot be given, and if the course does not permit of this minimum of per capita cost, vocational education should not be attempted.

All experiences in education, all the results of scientific studies have indicated that to be effective, education must be experience-centered. A sound curriculum, therefore, must have experience as its center if it is to be effective in the education of youth and adults. Vocational education requires an experience-centered curriculum.

Attitude Toward Present Collegiate Preparatory Curriculum

In Ohio, all high school graduates are eligible to attend state universities. If we will believe 30 years of research, those who can think, write, and read better than the average student are those who will succeed in universities. The Carnegie unit approach to curriculum organization imposed upon the public schools by our universities has absolutely no basis in research. Thirty years of research dealing with college success has proven that success in college correlates more clearly, more directly, with how well a student did in whatever he took in high school than it does with any specified set of subjects.

To report just the findings of two such studies, David Cook, in his study on "Predicting Success in College," summarized his findings in these words:

> It did not make a great deal of difference whether a student took a college preparatory course (with more mathematics, language, and science) or a non-college preparatory course so far as grades earned in college were concerned...
>
> Advanced study of languages in high school had no relationship to grades earned in foreign language in college.

Paul B. Diederich, in his article, "The Abolition of Subject Requirements for Admission to College," made this statement:

The only requirement for entrance to the University of Chicago is "that students be able to read, write, and think a good deal better than most students are now able to do."

Simple tests of these three abilities have a higher correlation with marks in all courses than any other measure ever devised.

Our system of public secondary schools, therefore, is in the grip of a standard curriculum which is based on the fundamental premise that the pursuit of certain prescribed studies is essential to success in college. It has been proved that this premise is false.

It is possible that our present high school curriculum is bankrupt. It is subject-centered in opposition to all that we know about the learning process. It worships at the altar of math and science as gods rather than as tool subjects. It assumes that the Carnegie unit requirements for entrance into college have a basis in actual college achievement, and this assumption has been thoroughly disproven. It accepts an 1850 concept of a curriculum organization geared to preparation for the professions as the basic curriculum for all youth. The curriculum in the majority of our high schools is not relevant to either the needs of youth or the needs of our modern society and must face a massive change.

Curriculum organization for vocational education must avoid the same practices and problems which have made the present high school curriculum bankrupt and must not allow itself to be restricted because it might interfere with the real high school educational program, "the college preparatory curriculum."

Principles of Curriculum Organization

Studies in curriculum organization have pointed the way to improved practices in education. While all of us have had to study curriculum organization, public education has tended to ignore improved curriculum organization because the teachers coming from the colleges are prepared to enter into only one type of curriculum pattern.

At the time that our high school were organized, the discipline-centered pattern of higher education, in which the disciplines were divided into subjects, was passed on down to the new high school organizations. This organizational pattern was established in the belief that if students were to succeed at the college level, studying subjects as they would in college was the way to prepare for success. It is sad, but true, that the junior high school also tends to follow the same subject-centered curriculum established for the high school.

Curriculum theory as studied in collegiate classes should point out that one way to encourage interest in learning on the part of students is to correlate instruction within two or more subjects in such a manner that a point of interest is used as the approach. Under

this approach, the student can see relationships between the subject areas. Experiences reported indicate that such a procedure for correlating subjects does serve as an interest stimulator for students. It is obvious, however, that the instructional program is still centered around the subjects, and observation of the educational programs in our public schools indicates that very seldom does a correlated subject-centered program continue such correlation for very long.

Another curriculum organization pattern encouraged in curriculum theory is that of integration of subject areas into one block of time, such as combining English and social studies. The concept here, however, is that you still have a block of subject matter to be imparted to students, but that you use the subject matter of one to teach the subject, content, and theory of the other. Such integrated programs have from time to time been successful, but since they still are centered in terms of teaching subjects, there has been no broad acceptance of this pattern of teaching within our public schools. While this integrated subject approach provides a better method of curriculum organization, it is still subject-centered rather than student-centered.

The eight-year study growing out of the Commission on the Relation of School and College established by the progressive Education Association in 1930 focused attention on a new type of curriculum organization called the "core curriculum." Dr. Harold Alberty, then Professor of Education at Ohio State University, was one of the foremost proponents of the core approach to curriculum organization. While in some sense the integrated or correlated subjects approach might be identified as a core curriculum approach, Dr. Alberty's concept started with the problem of the student as the center of the core, with subject matter, skills, and technical knowledge interjected into the program on an experience-centered base. While much of the core curriculum work in the eight-year study was built around social problems or around adolescent needs, Dr. Alberty, in his development of the theory of the core program, identified a pegged core concept in which the occupational goal of the student could become the center of the core and the experiences and knowledge necessary to prepare for this goal could become the basis for the curriculum organization.

The Smith-Hughes Act of 1918 and the 16 theorems of Prosser envisioned vocational education as a core program in which the student's occupational choice became the center. The core curriculum concept was proven sound in the eight-year study. Tis curriculum approach, however, is the most difficult approach in curriculum organization, since it does not provide for neat little blocks of subject-centered learning which can be organized and taught easily by the instructor and measured easily by appropriate tests.

Essentially, people in vocational education have been operating under the core curriculum concept. The new "Educational System of the 70's" program sponsored by the research unit in the U. S. Office of Education is essentially a return to this concept. The approach suggests that, to be effective, any study of mathematics, science, or other technical areas must be taught as an integral part of experience-centered efforts in the shop or laboratory or on the job.

Scope of Curriculum

In the early 1940's, the term "life adjustment education" became popular in education, but then fell into disrepute, mistakenly aligned in the minds of the public with progressive education and curriculum determination by "What do you want to do today, kids?" The life adjustment education concept, however, envisioned a concern for the whole student and not only a responsibility for teaching him subject matter and skills. A concern for the whole student would indicate a concern not only for his exhibited educational process in the classroom or laboratory, but also for the social, economic, physical and mental health conditions that had a bearing on his participation in the education program.

While educators for years have given lip service to this concept of concern for the whole student, education has not had the understanding, the financing, or the staffing to give more than lip service. This is to suggest that the educational curriculum cannot be separated from the supportive services involving enrichment or remedial education, social services, economic support, and physical and mental health services. Our experiences in the job corps centers and in Manpower Development and Training programs would suggest that schools that ignore the importance of these supportive services are encouraging high dropout rates, particularly among those from low socio-economic levels. Experience today would also suggest that the cost of welfare is such that it would pay society to make sure that an investment is made to enable every young person to enter and participate in our society as a tax producer rather than a tax consumer.

Investment in education and supportive services is perhaps the only solution to the social and economic problems of our day. Funds invested in these are truly an investment, not a cost. If this concept were to be accepted with the schools, it would affect all facets of the educational program, including facilities, equipment, staffing, student participation, and curriculum organization. Most approaches to curriculum organization have not given adequate consideration to the integration of support services as a part of the curriculum.

On this basis, then, curriculum for vocational education must be organized so that

preparation for initial job entry is a basic responsibility of the public education program.

the curriculum is goal-centered at age 16 and above. For most youth, this goal can be most meaningful when related to preparation for employment.

the curriculum is made relevant to the social and economic conditions of our day and to the maturity of our youth.

a core curriculum concept, based upon the occupational goal of a student, provides a meaningful preparation for employment in our technological society.

the curriculum concerns itself not only with the need for mastery of skills, but with total educational, economic, social and physical needs of each student.

Curriculum Organization Procedures for Vocational Education: An Instructional Design System

Attitudes and decisions about the foregoing concepts and recommendations provide the basis for curriculum organization for vocational education. Sound curriculum organization involves hard work, understanding of learning theory, and understanding of educational processes and procedures, often beyond the ability or time available to the individual teacher. While it is true that all teachers must participate in curriculum organization, it does not follow that all teachers can successfully organize a sound curriculum. Too many of our efforts in vocational education have been pointed at starting and understanding curriculum organization, rather than with complete development of effective curricula for the programs.

It is interesting that some of the early curriculum organizational procedures for vocational education grew out of experiences of early leaders who organized vocational education curricula for industry circa World War I. Charles R. Allen developed many of his concepts of curriculum organization from experiences in the shipyard. It is equally interesting that some of our newest concepts for curriculum organization are growing out of experiences in organizing curriculum for the training of employees in modern industry.

The initial step in the Instructional System Design (ISD) process seems rather obvious. If you want to prepare a young person to enter an occupation successfully, you must know what the occupation requires of the successful worker.

The first step in the process of curriculum development is occupational analysis – what the successful worker must be able to do on the job.

The second step in the Instructional System Design is the selection of a course outline from the tasks included in the occupational analysis, with the instructional goal to be achieved by the program as focal point.

The third step in the ISD system is the specification of instructional objectives in terms of the cognitive, psychomotor, and affective domains.

The fourth step in the ISD system is the identification of the instructional strategy to be followed. Such strategy is essential in order to assure an educationally sound approach to teaching the skill and related content, an adequate source of materials and jobs to provide the skills required in the occupation, adequate instruction and experiences on each task for each student, and a plan of student flow to assure the experiences for all students.

The fifth step in the system calls for a sequencing of the duties or tasks in the course outline, based upon the plan of instructional strategy arrived at in the fourth step above.

The sixth step in the system calls for a grouping of the tasks following the instructional strategy, planned in such a manner that demonstrations can be provided to broad groups and then small groups scheduled for actual practice in the duties and tasks using equipment and space available.

The seventh ISD step calls for selecting the related technical instruction content from the occupational analysis to correlate with the duties and tasks as grouped and scheduled in step six. This step also calls for organization of the instructional content to conform to the time line planned for the duties and tasks.

An eighth step in the ISD calls for planning both formative and summative evaluations. The formative evaluation will be a part of each demonstration or each lesson within the instructional program. Sub-summative evaluations will come at the end of groups of demonstrations or the completion of blocks of instruction. The summative evaluation will be based upon actual performance of the tasks by the students and eventual placement in employment.

The sections that follow will provide a broader description of each of the steps of the Instructional System Design. A glossary of terms used in its description is included in the Appendix.

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CHAPTER III

USING SURVEYS AND ANALYSES AS A BASIS FOR THE DEVELOPMENT OF COURSE OUTLINE

Definition: Occupational Analysis – a process that examines an occupation and lists the performance skills and knowledge which the occupation requires.

The process of instructional design has a logical beginning and a logical progression that ends with evaluation which shows that the students did learn and are able to perform.

The first part of this process of instructional design is the responsibility of the State Department of Education. After an occupation has been identified, additional information must be obtained about that occupation. Information from many sources can be utilized to develop a program that will prepare a student with satisfactory employment skills and knowledge for entry into the identified occupation. Common sources of information about an occupation are career handbooks, textbooks, various trade publications, individuals with work experience, advisory committees, and trade associations. All of these sources can help us get a clearer picture of the occupation. But not all are designed primarily to provide information for curriculum design and development.

The occupational task survey technique produces curriculum data that are reliable, quantifiable, and valid. However, before an occupational task survey can be conducted one must obtain or develop a list of tasks performed in the occupation. The task list is a comprehensive list of statements which define actual units of work performed by practitioners of the occupation. These lists, which describe what people do when carrying out their job responsibilities, are compiled from a number of sources, including job descriptions, training materials, worker interviews, observations, and simulations. To maintain consistency in the level of specificity and style, the task statements contained in the list should be written according to a set of standards. This is most important, because:

A. at this stage the required work performance is spelled out in the task statement; and
B. the scope of the program will be reflected in the nature of the completed task list.

Once the task list has been secured, a statewide survey is conducted. The information gathered by this survey at the state level includes:

frequency of task performance and the percent of workers performing the task.

The data gathered by this survey (See Tables 1 and 2) provides for assignment of priorities to the tasks based on how often they are performed and how many workers actually perform them. This process involves determining the percentage of workers that perform a task before it becomes a

TABLE I

SAMPLE OCCUPATIONAL TASK INVENTORY SURVEY INSTRUMENT

TASK INVENTORY DENTAL ASSISTANT	Frequency of Performance					Importance of Performance				
	Never	Seldom	Occas.	Freq.	Average	None	Slight	Mod.	Gr[illegible]	Average
Microbiology and Sterilization										
5. Scrub and sterilize instruments for autoclave	3	3	3	56	2.72	5	0	6	55	2.72
6. Wrap and pack instruments for autoclave	4	4	6	51	2.58	6	0	6	54	2.68
7. Clean container, prepare chemicals for sterilization	0	4	9	52	2.74	3	1	4	57	2.74
8. Prepare, sterilize instruments for chemical sterilization	3	2	4	56	2.74	5	1	3	56	2.69
9. Prepare, sterilize instruments in hot oil	14	29	4	18	1.40	18	11	14	22	1.61
10. Prepare, sterilize instruments in boiling water	13	34	6	12	1.26	13	20	8	24	1.66
11. Prepare, sterilize instruments in dry heat and alcohol	9	17	8	31	1.94	12	7	10	36	2.08
12. Prepare, sterilize instruments using ultrasonic	7	10	13	35	2.17	11	3	12	35	2.03
13. Store surgery instruments	2	6	8	49	2.60	5	4	10	46	2.49
14. Store operative instruments	0	2	4	59	2.88	0	2	7	56	2.83
Dental and Lab Materials										
1. Mix zinc oxide-eugenol for base and temporary	1	1	8	55	2.80	3	1	7	54	2.72
2. Mix zinc phosphate for temporary, cementation, base fillings	1	3	10	51	2.71	4	1	6	54	2.69
3. Mix amalgam for restorative purposes	3	1	2	59	2.80	5	0	2	58	2.74
4. Mix silicate for restorative purposes	6	7	8	44	2.38	8	1	6	50	2.51
5. Mix resin for restorative purposes	5	7	11	42	2.38	9	2	4	50	2.46
6. Mix acrylic for restorative purposes	4	10	13	38	2.31	8	3	6	48	2.45
7. Prepare gutta-percha for temporary fillings	8	18	21	18	1.75	13	7	15	30	1.95
8. Select and bead trays	7	21	22	15	1.69	11	7	16	31	2.03
9. Mix alginate to take an impression	2	6	7	50	2.62	8	2	7	48	2.46
10. Box an impression	4	21	12	28	1.98	8	8	15	34	2.15

TABLE 2

SAMPLE TASK WEIGHTING AND RANK ORDERING

Dental and Lab Materials

Mean Value	Task No.	Task Statement
2.80	1	Mix zinc oxide-eugenol for base and temporary
2.80	3	Mix amalgam for restorative purposes
2.71	2	Mix zinc phosphate for temporary, cementation base fillings
2.62	9	Mix alginate to take an impression
2.46	16	Mix rubber base and load syringe for impression
2.45	11	Pour a plaster mold
2.42	12	Pour a stone model
2.38	4	Mix silicate for restorative purposes
2.38	5	Mix resin for restorative purposes
2.31	6	Mix acrylic for restorative purposes
2.29	13	Trim a stone and plaster model
2.26	14	Make a partial and complete impression tray (custom)
1.98	10	Box an impression
1.92	19	Prepare compounds for impressions
1.89	17	Mix silicones for impression
1.88	21	Construct wax rims
1.80	15	Mix metallic zinc oxide base for an impression
1.80	20	Construct a base plate
1.75	7	Prepare gutta-percha for temporary fillings
1.69	8	Select and bead trays
1.60	22	Articulate models
1.57	18	Prepare hydrocolloid for an impression
1.57	27	Construct an acrylic temporary crown
1.40	23	Carve wax patterns
1.35	24	Sprue and invest wax patterns
1.29	26	Clean and polish wax patterns
1.18	25	Cast wax pattern

priority item to be considered for instruction. It is inefficient to instruct an entire class on how to perform a task if it is actually performed by a very small percentage of workers, or if it is obsolete or very specialized. At the state survey level, only limited information is gathered (frequency of performance and importance of the task). Local surveys could include more detailed and localized information (task criticality, O. J. T. or in-school training, etc.). Generally, the more data one gathers and interprets, the more reliable and valid is the prioritized task list. At this point, one must analyze the occupation, that is, document the required job performance and its accompanying related knowledge.

The task list is important and basic to an occupational analysis, but a task list alone is not an occupational analysis. While the skills, knowledge, content, disciplines, and other factors related to an occupation will differ with each, it is possible to establish a plan for an analysis of important data relating to each of the tasks in an occupation. The analysis can serve additional functions in the development of a curriculum leading to entry skills in each occupation.

Duty blocks, groups of identifiable related tasks, make up large segments of an occupation. The occupational analysis is concerned with each task within a duty block; each occupation in turn normally will have a number of duty blocks.

Charts 1 and 2 illustrate a format for the occupational analysis of a task statement "refinished with acrylic enamel," which is part of a broader duty entitled "refinishing," which is one of the duty blocks in the occupation identified as auto body mechanics.

It is a rare individual who has sufficient background and knowledge to develop an analysis on an individual task statement, much less the competency to complete an occupational analysis on all tasks in an occupation. It is recommended, therefore, that a team be assembled of competent persons working in the occupation at the time of the analysis. This would include instructors in that occupation who also have occupational competency and persons with competency in the disciplines of mathematics and science or other related disciplines of importance to the occupation. Such a team can follow the format outlined in Chart 1 and make an analysis of the respective occupation preceding in the development of a course of study.

It can noted from a review of Charts 1 and 2 that the items most directly related to the performance of the tasks are blocked in bolder black outlines and identified as performance knowledge, decisions, cues and errors. Such data can be of significant help to the instructor as he plans the demonstrations within the laboratory as well as topics of related instruction. The content included under the headings of tools, equipment, materials and objects acted upon, and "safety/hazard," assist the instructor in preparing for the demonstration and in planning for specific points of emphasis in terms of important safety hazards. The content of the analysis listed under the headings of science, math, and communication becomes the basis for related technical instruction which reveal the "Why" behind the "How" in order that the student will better understand current practice and better accept and understand changes that come into the occupation with technological advances. An occupational analysis, therefore, lists related tasks under broad duty statements, with

CHART I

(TASK STATEMENT) REFINISH WITH ACRYLIC ENAMEL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	STEPS	SAFETY – HAZARD
Bucket, sponge, car soap Wax remover chemical Toweling and rags Masking tape and paper Metal conditioner Primer surfacer Sandpaper and disks Blow gun and tack rag Glazing putty Lacquer thinner and enamel reducer Sealer Spray guns Acrylic enamel Spray booth Power sander Air hose	Wash and dewax car Featheredge broken areas Treat bare metal with metal conditioner Mask all surfaces not to be painted Prime all featheredged areas Apply glaze putty Sand entire automobile Remove sanding sludge with water Wash sanded surface with chemical Blow and tack Apply sealer Blow and tack again Apply acrylic enamel reduced in accordance with label directions Unmask and clean up	Eye protection - eye injury Observe standard safety rules for all power equipment and compressed air Spray booth - fire, dirt in finish Spray respirator - breathing vapors Thinners and reducers are inflammable - fire
DECISIONS	**CUES**	**ERRORS**
Type of thinner and reducer Type of sealer Amount of material	Weather temperature Color of automobile Size of automobile	Orange peel or runs and sags Poor coverage Insufficient material
34		35

CHART 2

SCIENCE	MATH – NUMBER SYSTEMS
Fluids under pressure (atomization and compressed air) Centrifugal forces developed by bodies in rotation (operating power sanders) Effects of friction on work processes and product quality (friction while sanding) (humidity/temperature) Behavioral Science (see index)	Ratio and proportion, estimate (ratios - paint and materials) Ratio and proportion, estimate (reduce metal conditioner) Use of numbers (without calculations) (grit and dimensions)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Label directions	Comprehension, detail/inference, informational reports, recommendation reports, description of mechanisms, definition, terminology
Speaking	Shop foreman Peer group	Terminology/general vocabulary, clarity of expression, logic
Feeling	Level areas	Shape, depth, consistency, texture

an analysis of each task which guides the instructor in both the laboratory and classroom.

It must be emphasized that an occupational analysis is not a course of study. It merely identifies the scope of the tasks and the instructional content that is related to each. The content identified with one task many times will be duplicated in a number of other tasks because the task lists are not in any sequential order. No one course of study will include all of the tasks in the analysis. As indicated at the beginning of this chapter, the development of occupational analyses should be the responsibility of a state or a broader agency than an individual local program. Where no occupational analysis exists, it will be the responsibility of the leadership within local programs to develop an abbreviated occupational analysis using the procedures identified in this chapter. It is the goal of the Division of Vocational Education in the state of Ohio to develop occupational analyses for all of the occupational areas which have multiple program sites in the state.

Definition: Course outline – A list of tasks which are selected to be taught in the local program. This list is selected by the local supervisor, instructor, and advisory committee after analyzing the occupational data.

Procedure:

To continue the instructional design process, the responsibility must now shift to the local educational program level. The first area of local responsibility is that of developing a course outline. Course outline development is the responsibility of the local supervisor working directly with the advisory committee and the instructor. The course outline is merely a list of the tasks selected to be taught. These tasks can be organized under duties.

The first step in developing the local course outline is to acquire the relevant occupational analyses. These analyses must be examined to determine if they contain the necessary tasks. This determination should be made by the supervisor working directly with the advisory committee and the instructor. If the tasks that are included in the analyses are not complete or acceptable, consideration must be given to including additional tasks. To determine which tasks to add, one or more of the following methods may be used:

1. Interviewing knowledgeable workers
2. Observing workers
3. Simulating that part of the occupation
4. Making assumptions, which must be validated

The next major step in the development of the local course outline is to determine the answers to the following questions:

1. Are the tasks entry level tasks?
2. Should the tasks be taught in the school or on the job?
3. What is the percent of local workers performing the job?

The supervisor, advisory committee, and instructor must answer these questions before they select which tasks to include in the course. These questions may be answered by conducting a local survey.

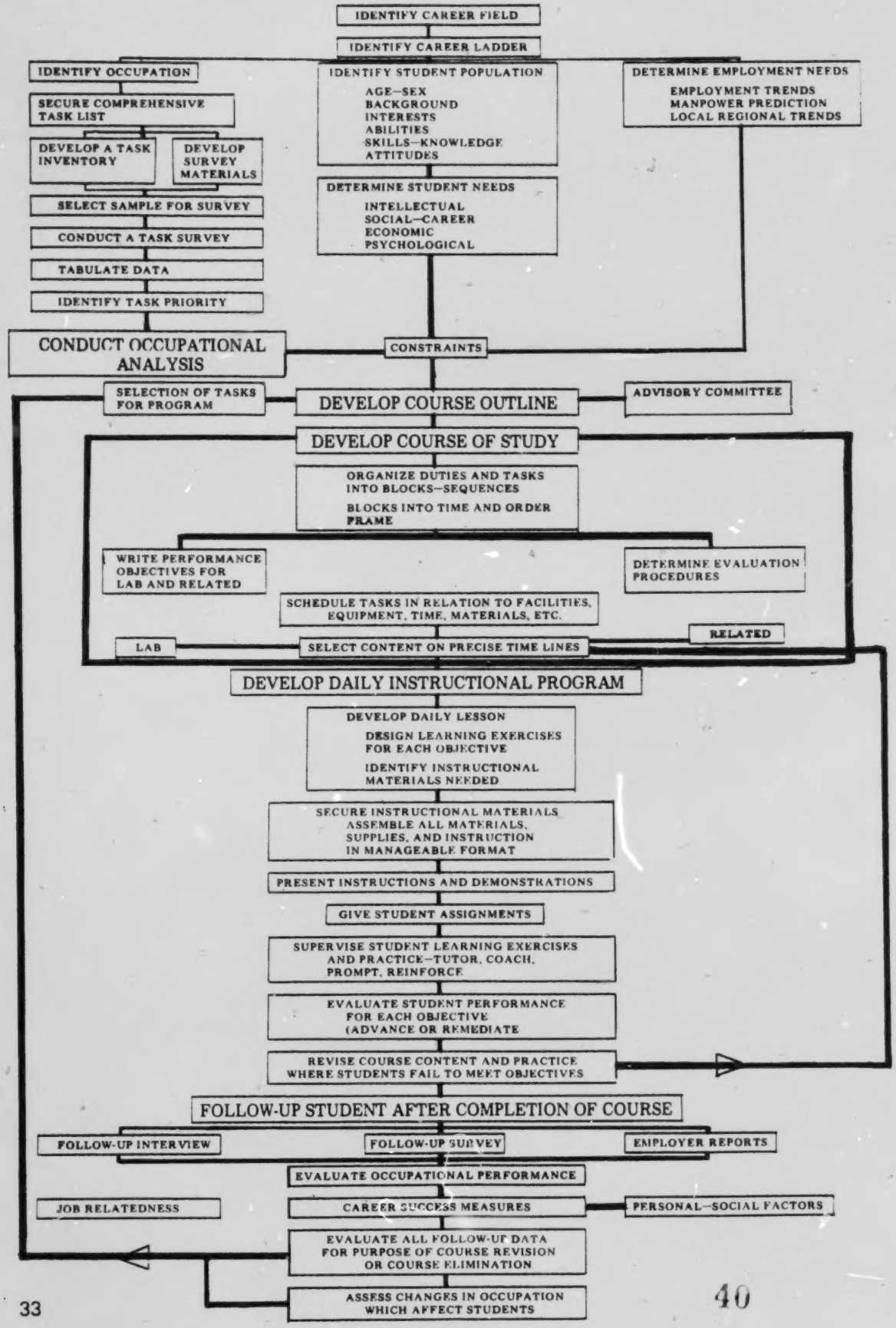
The next step involves the selection of duties and tasks for which instruction will be planned. A sample task list form for use in local surveys or with advisory councils is included in the Appendix. The basis for selection of these duties and tasks will be the survey data and the decisions of the supervisor, advisory committee, and instructor. However, other educational considerations should be taken into account when reviewing the survey data, drawing conclusions, and making decisions about instruction. Some tasks may provide a good medium for teaching a certain skill, or they may have student motivational value. Some tasks, although not performed often, may be basic to learning more advanced tasks. Local consideration, such as these, can be determining factors for tasks that are not clearly discriminated by the survey data.

Once the duties and their tasks have been selected and organized, they should be sequenced into a preliminary teaching-learning order. The final sequence, however, cannot be completed until one looks at content.

In the event that tasks are added to the list, and become part of the outline, it must be determined if there is an analysis available for them. If there is not, it will be necessary to analyze the added tasks before proceeding to the development of the course of study.

Chart 3 is an organizational chart of the ISD system, and as such shows the relationship of occupational analysis and course outline to the system. These are two important and basic steps within the total Instructional System Design concept. As indicated earlier, the individual instructor does not have the time to develop a total occupational analysis. While the instructor will serve as a member of the team in the development of the course outline, the responsibility and authority for the final approval of the course outline rests with the school administration and the board of education.

Chart 3
I.S.D. MODEL



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CHAPTER IV

INSTRUCTIONAL OBJECTIVES

Definitions: An instructional objective is an intent communicated by a statement describing a proposed change in a learner – what the learner is to be like when he has completed a learning experience. Program objectives – broad program outcomes which integrate both learner and organizational objectives for the purposes of long-range planning and program development.

Mager[1] defined an objective as

> "a description of the performance you want learners to exhibit before you consider them competent."

There must be measurable *attributes* observable in graduates of a program or it is impossible to determine whether or not the program is meeting its objectives. *Without clearly defining instructional objectives, it is impossible to evaluate* a course efficiently *and there is no sound basis for selecting appropriate materials,* content, or methods.

Most literature focusing on objectives begins with an analogy which emphasizes the need to plan where one is going and how one will know when he gets there. Koberg and Wagnall[2] pointed out in *The Universal Traveler* that it makes little sense to be on the way if there is no way of knowing when the goal is attained. The key to reaching goals is to have an objective which is stated in the most meaningful and measurable terms.

If teaching is to be . . . . a goal-directed activity, a clear statement of objectives must precede learning activities. A general definition of teaching was offered by Miles and Robinson[3] in "Behavioral Objectives: An Even Closer Look":

> "Teaching is the process of arranging learning experiences to facilitate students' attainment of cognitive, affective/and/or psychomotor objectives."

If these definitions are accepted, they require that we carefully examine the instructional objectives which are written and the evidence that infers goal attainment. The use of measurable objectives also indicates a willingness to deal with data *indicating success as teachers.*

An additional advantage of clearly defined objectives is that the students know what is expected and can spend their time and effort on meaningful learning activities instead of "psyching out" the teacher.

In *Teaching: Description and Analysis,* Hough and Duncan[4] define instructional objectives as statements of intent that focus the teacher's attention directly upon *what the teachers and their students will be doing* in the classroom. Instructional objectives which are stated in terms of student performance serve three primary functions:

1. They focus teacher attention on what they will be doing in the instructional setting.
2. They focus the student attention on what is expected of them as a result of their participation in the instructional situation.

3. They make public the criteria on which the measurement of student achievement will be based.

In writing instructional program objectives, the concern is directed toward learner objectives. These objectives are further defined as being

> . . . . .measurable predictions of what a learner will be able to do or produce in order to demonstrate his knowledge, skills, preferences, or beliefs resulting from an instructional experience. This may include a *learner state, action, attitude, competency* or *product.*

STRUCTURE OF OBJECTIVES

Measurable objectives are precise statements predicting tangible benefits resulting from instructional efforts. A precise objective contains three kinds of information:

1. Outcome - *what* is to be achieved.
2. Level of Achievement - standards or criteria to determine *how well* it is to be achieved.
3. Conditions of performance - under *what circumstances* it is to be achieved.

Mager based the structure for instructional objectives on identifying the *terminal behavior,* describing the *conditions* under which the behavior will occur, and specifying the *criteria* for acceptable performance.

Another question relates to the action word or verb. Does the objective indicate performed action such as list, define, state, diagram, locate, sand, construct, paint, participate, present, predict, or describe?

How about ones like compare, evaluate, differentiate, or recognize? How will we know when someone is doing one of these? If the action is "covert", how about "adding an indicator" that we can "observe" to show what's happening? What will they do or be able to do - when they are recognizing? Point to, perhaps?

Verbs such as understand, appreciate, know, or comprehend are general as well as covert and require explanation in more detail before they can become objectives that we can observe or measure.

CLASSIFICATION OF OBJECTIVES

Objectives can be classified in the three educational domains using a system such as ASK by Hough and Duncan[4].

> A - Affective domain – which includes values, attitudes, feelings, and emotions. S - Skill or psychomotor domain – which includes manipulation of materials and objects. K - Knowledge or cognitive domain – which includes mental and intellectual abilities.

Some objectives are a combination of the domains. For example, the ability to run a machine may involve both knowledge and skill.

Affective domain objectives require analysis and definition before we can either write them or attempt to measure them.

Mager[5] cautions us not to leave out this important domain. He offers some aid for writing affective objectives in his book *Goal Analysis*. One technique for writing affective objectives is to do a goal analysis to determine the indicators of a certain behavior. For example, what are some of the indicators or behaviors of a "good citizen," "a professional attitude," or "acceptance or responsibility?"

Many resources for writing objectives are available to teachers and several are listed in the bibliography. Most of the resources provide not only the "how to" of writing instructional objectives, but examples of various types of objectives.

The following are examples of objectives and their level of specificity for use in the ISD system:

Program Objective: Very general goals, that in total provide a broad overview of the entire program. They establish the program parameters, and provide a broad basis for evaluations.

Program: Auto Mechanics

1. Upon completion of the automotive mechanics program, all students will be able to perform each duty included in the instructional program at an occupational entry level in accordance with industry approved automotive mechanics standards of practice and performance common to independent or dealership garages.
2. Each student will be able to demonstrate a knowledge of automotive nomenclature, technical information, procedural steps, principles of math and science, and factors of communications required in the maintenance and repair of automotive units related to the duties included in the instructional program. Students will demonstrate their ability to apply such knowledge and understanding within the laboratory in accomplishing the assigned laboratory tasks, and will further demonstrate their ability to adapt and apply knowledge and principles learned in relation to advances in automotive technology.
3. Students will demonstrate proper procedures and respect in the use of tools, work performed on customer vehicles, and in maintaining a safe, clean work area. In addition, students will demonstrate their capabilities in working both as an individual and in a team relationship, and will further demonstrate punctuality and regular attendance on the job as a result of experiences acquired through the instructional program.
4. Students will demonstrate their abilities in using auditory, tactile, olfactory, perceptual and the interrelationships of these sensory factors in the diagnosis of automotive malfunction which may relate to one or more of the instructional program duties or tasks.

Program: Clerk-Steno

1. Given dictation at the minimum rate of 100 w.p.m., the clerk-stenographer will be able to record the information accurately in accordance with instructions and transcribe accurately at a minimum rate of 30 w.p.m.
2. Given assignments which will include notes, memos, reports and letters, the clerk-steno will be able to compose letters, if necessary, with appropriate content and type letters, forms, reports, or memos in a mailable form according to actual business operations.
3. Given a batch of incoming mail and a batch of outgoing mail in a simulated office the clerk-stenographer will be able to appropriately open, sort according to importance,

and disperse incoming mail to appropriate persons and will be able to affix proper amounts of postage and sort mail according to zones, if necessary, for outgoing mail.

4. Given the assignment of handling banking procedures, the clerk-steno at the completion of the banking unit will be able to handle incoming funds, endorse checks correctly, accurately prepare bank deposit slips, reconcile the bank statement and account for all monies in a petty cash fund.
5. Given business transactions, the clerk-steno will be able to accurately journalize and post all transactions, including the maintenance of the accounts receivable and accounts payable journals.
6. Given time cards for a group of employees, the clerk-steno will be able to accurately compute, through the use of a calculator, assemble, and prepare payroll records and payroll checks.
7. Given a simulated office situation in the form of a case problem which includes a telephone communication, the clerk-steno will be able to recognize through voice tone and questions asked the attitude of the caller and be able to appropriately respond to the caller, giving necessary information and using acceptable human relations.
8. Given reproduction equipment in a B.O.E. laboratory and material to be duplicated with instructions as to the use of the material, the student will be able to judge which process is to be used – photocopy, stencil, spirit or offset duplicating, and then duplicate material.
9. Given a drawer of correspondence to be filed, the clerk-steno will be able to sort, code, index and place each piece of correspondence in appropriately labeled file folders, according to alphabetic, geographic, subject, or numeric filing systems ready for immediate retrieval or transfer as needed to meet entry level requirements of the occupation.

Module Performance Objective: A module is defined as "a subdivision of a group of tasks or competencies composed of lessons to be taught in close sequence." The module performance objective would be more specific than the program objectives and includes statements addressing each competency covered in the module.

Program: Auto Mechanics

Given an auto needing a "minor tune-up", the student will be able to determine the condition of ignition wires, plugs, points and condenser, and replace parts as required – to include adjusting the points and plugs. All work completed according to manufacturer's specifications and according to flat rate time manual plus 25% at 100% accuracy.

Program: Clerk-Steno

Given a "Set of Books" and the original papers generated in a month, student will be able to record all items and make summary reports as required for that operation - to include a Bank Reconciliation, with 100% accuracy.

Task Objective: Relate to a given task which is a component of the MODULE. This level may be concerned with a single operation – or may require multiple statements.

Program: Auto Mechanics

As a part of a "minor tune-up" the student will be able to determine the condition of ignition wires – using an induction firing indicator, remove those indicating malfunction and replace them on both

the distributor and spark plugs keeping them in proper order at both ends, according to flat rate time manual plus 25%.

Program: Clerk-Steno

Given the assignment of reconciling a bank statement, the clerk-steno will be able to identify outstanding checks, service charges, cancelled checks, and outstanding bank deposits, with 100% accuracy.

The exact number of levels of objectives can be expanded; some people in the field use as many as five; i.e., program, duty, module, task, and enabling objectives. In the vocational education instructional process there must be measurable attributes observable in graduates of a program or it is impossible to determine whether or not the program is meeting the objectives. Without clearly defined *instructional objectives* it is impossible to evaluate a course efficiently and there is no sound basis for selecting appropriate materials, content, or methods.

A course of study has been defined as a comprehensive and detailed plan which shows the scope and sequence of content, and the organization and management of all instructional activities for a specific course in the curriculum.

If the course of study is to be a meaningful and viable document then it must address and include at least two of the different levels of objectives – program objectives and module objectives.

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CHAPTER V

DETERMINING INSTRUCTIONAL PROGRAM STRATEGIES

Definition: Instructional Strategies – Methods of planning, organizing, manipulating, and integrating facilities, equipment, instructional aids, materials, time, and students within the limits of school policy for the purpose of teaching tasks and related content.

Strategies to be Considered:

Following the determination of the tasks to be included in the program of instruction, through the updating of the course outline and establishment of the objectives for the course, the next step in the curriculum organization is the determination of the instructional program strategies. The program objectives establish the goals; the strategies must then be identified with consideration of the physical facilities and equipment available, the number of students involved, the availability of instructional materials, and the relative support for the program from business and industry within the community.

One of the first steps in establishing strategies is to determine the type of curriculum organization on which the instructional program will be based. The basic methods of curriculum organization are as follows:

A. Subject-centered curriculum – the curriculum is centered in subjects related to the disciplines, with each subject standing on its individual merits and being taught as a discrete body of knowledge.

B. Correlated curriculum – instruction is again based upon discipline-related subjects, but an effort is made by teachers to correlate their efforts by teaching similar concepts at the same time.

C. Integrated curriculum – this curriculum organization is characterized by one teacher teaching two different subjects within a specified period of time, with freedom to flow the subjects within that period of time. The teacher, however, has a responsibility to cover the content assigned to the two subject areas.

D. Core curriculum – a center point for the curriculum is established and all of the psychomotor, cognitive, affective, and perceptive program content is organized on the basis of that core. Within vocational education the occupational goal would be the center point of the core, then all psychomotor, cognitive, affective and perceptive content for instruction would be built around that goal in accordance with the objectives established.

Vocational education lends itself well to a core curriculum in which the occupational goal of the student becomes the center point for the program and all of the skills, technical knowledge, discipline-related instruction, and development of work habits and attitudes are addressed to that goal.

It is strongly recommended that the core curriculum concept serve as the basis for the curriculum organization for vocational education. The structured vocational program which provides a broad block of time for the psychomotor or task-oriented instruction and additional time for the cognitive elements of the program lends itself well to a core curriculum organization.

Another factor in the selection of instructional strategies is the determination of the basic method to be used in presenting the psychomotor or task-oriented part of the curriculum. Several different methods may be used, depending upon the physical facilities, equipment, and instructional materials available. In teaching the tasks that make up an occupation, instruction can be given through practice upon actual jobs involved in the occupation. A second method is practice of the tasks upon models taken directly from or related to the occupation. A third method is simulation of tasks, but not practice upon actual units or materials used in the occupation.

Based upon the principles of learning, the first method described above, practice upon actual jobs, would be the most effective in providing the competencies necessary to enter directly into employment upon graduation. Prosser stated it this way, as one of his sixteen theorems: "Effective vocational training can be given only where the training jobs are carried on in the same way with the same operations, the same tools, and the same machines as in the occupation itself." Basic to the selection of the method to be used is the availability of the work units upon which the students will practice.

Another determination is whether task demonstrations will be given to the total class, small groups, or individuals; whether students will receive instruction only on a "coaching" basis in which they learn serially as the instructor gets to them in turn, or learn from a peer who has already gone through the process. While demonstrations to individuals or small groups may be desirable, this process may not always be possible and class demonstrations may be necessary. Well-organized class demonstrations followed by coaching of small groups during practice is superior to the serial approach or training from peers.

Another factor in the determination of instructional strategy is the concept of the order of approach. Decisions must be made concerning in what order the tasks will be taught. Generally, consideration is given to ordering the tasks from simple to complex, or in a normal job order. However, there are other concepts and strategies that may determine the order of approach: one may

wish to teach from parts to the whole, or from the whole to the parts; from familiar to unfamiliar; teach the prerequisite knowledge first; or develop an order based on frequency of performance. Whatever strategy or combinations of strategies are used, the important thing to remember is that the order is arranged to provide the most efficient and effective learning.

Another factor within the area of instructional strategy is one that will be determined by the physical equipment within the laboratory. Will all students be instructed on the same task at the same time? Or will it be necessary to group the students into teams and to rotate those teams among tasks because a limited amount of equipment restricts the number who can work on a certain task at any one time? In most vocational programs there are not enough pieces of each item of equipment to permit all students to practice the same task performance at the same time.

Basic to vocational education, however, is the concept that all students will be brought to at least a minimal level in all tasks in accordance with the objectives of the program. It will be necessary, therefore, to decide on a strategy which will permit the scheduling of students either as a total class when the number of items of equipment will permit, or in small groups, when the items of equipment are limited. The limitation imposed on most vocational programs by equipment is a serious one which can't be ignored. Each student must gain adequate experiences in all of the required tasks. It is not enough that all of the tasks are listed in the curriculum; the strategy of scheduling student experiences must provide for all students to participate in all tasks in a logical and meaningful instructional plan.

Following these determinations, a decision must be made regarding the source of the practical work or the simulation materials that will become the basis for much instruction. As mentioned earlier, it may be the case that a combination of practical work on live jobs with task assignments on models, mockups, or simulation materials may need to be used. Existing physical facilities and equipment provide both support of and limitations to the practical work that can be included. In addition, certain occupations such as health occupations, cosmetology, intensive office practice, and others may require the development of certain basic skills through simulation or practice modules before students can participate effectively in actual work.

The source of the practical work and the plans for the flow of the practical work, however, must become a part of policy and plans for the curriculum. In the area of auto mechanics, for example, if automobiles are required, a plan must be formulated which outlines how these automobiles will be obtained in the order in which they are needed. The instructional program, and not service to customers, must be the basis for selection of the units to be included for practical work. In some cases, it may be necessary to reach out into local industry and business to get certain materials on which practice is needed but which cannot be obtained through school-purchased materials.

Another strategy that must be identified is that of coordinating task skill with related technology instruction. One teacher may be assigned to both, or separate teachers may be assigned for the shop and related instruction. Correlation of the laboratory and related instruction becomes more difficult through the use of separate teachers; practical aspects of the related instruction may suffer.

Even if one instructor teaches both the laboratory and related content, a strategy must be evolved for correlating the two types of instruction. The section on organizing related instructional content describes a pattern for coordinating the related instruction with instruction in the laboratory.

Instructional strategy also deals with tools for student use. Will all tools be furnished by the school and kept on boards at a central point or in a tool cage? Will kits with the common tools be purchased by the board and loaned to the students? Or will students be required to purchase certain basic tools, with the school supplying others?

An additional step is provision for the supply of parts needed in the instructional program. Who will pay for the parts? To what account will they be charged? What will be the policy whereby students obtain the parts? Will the parts be paid for through the school, to be reimbursed by the customer after the completion of the job, or will the person or company supplying the practical work supply the parts with the job? Basic to any plan for parts must be the understanding that students may not be sent out of the schools for parts or supplies unsupervised by the teacher.

Evaluation is an integral part of the instructional and learning process and as such, a strategy for evaluation must be determined. Once the instructional program is underway, some sort of evaluation is essential to determine what and how well the students learn. Evaluation is a means of determining how well both the instructor and the students attain the predetermined objectives of the instructional program. Therefore, effective evaluation begins with clearly defined objectives including acceptable standards of performance.

In determining a strategy for evaluation, the instructor must plan for measurement of student progress at all levels of instruction. Instructors may wish to use written or oral examinations, or performance rating devices at the conclusion of each lesson or group of lessons. The construction of evaluation items is greatly simplified by referring to the written performance objectives on which the instruction is based.

In addition to evaluation at the end of lessons or groups of lessons, the instructor must develop a plan of evaluation that will evaluate the student's overall success in attaining the total objective of the program. To be most effective, the evaluation process must be planned and continuous. For the evaluation to be usable it must yield conclusions that can be interpreted by the school, the instructor, and the student. In determining evaluation strategies to use, the instructor should consider a variety of evaluation methods.

Essentially the instructional strategy developed following the statement of the objectives requires the program planner to think through the integration of physical facilities, equipment, instructional aids necessary for the teaching of tasks, numbers of students enrolled, and strengths and limitations of school policy affecting the instructional programs. This is necessary to lay a base for the scope and sequencing of course outline and the remainder of the course of study. The concept of

demonstration for every task to be performed and the performance of that task by each student to at least a minimum level of competence requires the development of sound instructional strategies.

Summary of Strategies

The following is a suggested list of areas of concern which should be taken into consideration in developing a statement of program strategies as a part of a course of study:

1. Curriculum organization
2. Method(s) for presenting the task-oriented part of the curriculum
3. Plan for demonstrations
4. Plan for order of approach to the total list of tasks
5. Organization of students for actual practice of tasks (total class at same time or grouping)
6. Source of practical work or materials
7. Production work or individual projects or both
8. Plan for coordinating skill and related instruction
9. Plan for student tools
10. Plan for parts and supplies
11. Plan for evaluation

CHAPTER VI

SCOPE AND SEQUENCE OF TASKS

Definitions: Scope – the depth and breadth of the task and instructional content to be taught in a particular course.

Sequencing – the process by which learning experiences are structured to provide the most learning in the shortest time; arranging tasks in the most appropriate order for effective learning.

Scope of the Course

Assuming that the steps previously discussed have been completed in the development of a course of study, a course planner must try to balance the tasks so that an appropriate number of experiences may be offered in each unit of instruction. The problem of scope goes beyond the listing of tasks. The task list may have too broad a scope. Perspective is needed to fit a profusion of tasks into limited periods of time at appropriate stages in the students' development.

The scope of the course can most readily be kept within bounds by planning all instructional activities in accordance with course objectives. If the scope of the course is to stay within bounds, the objectives must be kept from becoming too numerous and diffuse.

The length of instruction for each unit will determine how many tasks may be selected from the analysis and placed in the main divisions of the course. Factors to be considered in arriving at the scope of the course include:

1. Tasks selected should be at the entry level of the occupation.
2. Selection should be limited to basic tasks that can be learned within a reasonable level of competency.
3. Tasks should be kept within the scope of the equipment available.
4. The time available for teaching all tasks should be specified.
5. Tasks should be included on basis of frequency of use.
6. Tasks selected should be arranged into major units of the course.

Sequencing of the Instructional Content

After the scope of the course has been established, the order of instruction would naturally follow. Generally, sequencing depends directly on the nature and structure of the selected tasks and duties which comprise the units of learning. In view of some of the principles of learning, it might be well to orient the sequence to students' developmental level rather than to the subject matter. A few of the learning principles that relate to sequencing are:

1. The rate of learning depends upon the difficulty of the task, the background, and the mental, emotional, and physical condition of the student.

2. Learning is most effective when built on something the student already knows.

3. The student learns step by step, but he must see how each step fits into the total structure.

4. The more often students use what they learn, the more effectively they use it, the better they understand it, and the longer they retain it. This is the basis of habit formation.

5. Transfer of learning from one situation to another is proportional to the similarity of structure and meaning in the two situations.

If the sequential order is student-centered rather than subject matter-centered, the following principles may help to determine a good learning order:

1. Sequence the tasks and content for early need.

   There are times when a student needs to learn very basic skills and knowledge before he can carry out the steps required to perform a selected task. For example, cooking success begins with exact measuring. "How to Measure," therefore, must be one of the first items to teach. This item could be considered a prerequisite needed for most cooking skills, or it could be listed as a step in learning to bake a cake.

2. Sequence the tasks based on the normal job sequence.

   For instruction which has to do with overhaul of equipment, it is necessary that certain tasks be performed in a definite order, such as dissembly, cleaning, inspecting, repair or replacement, assembly, and testing. The student must learn this order. Sometimes the most difficult task may be the very first one. In some jobs, the various tasks do not follow a regular order from simple ones to complex ones.

3. Sequence the tasks for frequency of use.

   Tasks which students perform frequently must be learned early in the course. In a horticulture course, sterilizing the soil is a task that a student must do repeatedly on his first and every successive job. This task should be learned early.

4. Sequence from simple to more complex.

   The completed course of study should be so arranged that the more simple tasks precede the more complex ones. In an ideal situation, each task performed by the student should be a little more complex than the previous one. Usually it is not possible to get a uniform progression from simple to complex. The course planner should use this

progression to the extent possible, however.

5. Sequence the tasks so that each new task is built on something the student can already do.

   When new tasks are tied to tasks which the student can already do, they become more meaningful to him and become a springboard for further learning.

In summary, the process of scope and sequence takes in two aspects of learning – how much should be included in a two-year vocational course, and how can it best be arranged so that effective learning can take place?

CHAPTER VII

GROUPING AND SCHEDULING FOR THE INSTRUCTIONAL PROGRAM

Definitions: Group – A series of tasks or modules grouped together for instructional purposes and placed in a general time frame.

Schedule – A timed plan for the rotation of students through the practice of a series of tasks or modules.

Module – A subdivision of a group of tasks or competencies composed of lessons to be taught in close sequence.

The first model for the instructional system (ISD) showed the organization of duties and tasks into blocks as one part of the system. According to the model suggested, the block was a major section of the course of study. Whether the block of the course of study corresponded to the block of the occupation remained to be seen. It depended entirely on decisions as to the best design of the system for helping students reach their goals and objectives. The term *block,* in this sense, is sometimes used interchangeably with the word *group.* For the purpose of describing related tasks to be taught and practiced by the students at one period of time in the instructional program, this section will employ the term "grouping."

While the clustering of tasks or duties may provide a systematic orientation to one's thinking in terms of an analysis, it does not always assure the most desirable organization when attempting to arrange the elements in the best possible way for the instruction of students. When arranging the tasks or duties into an instructional system, other variables have their impact. The nature and number of the students, type of facilities, equipment, materials, and time – all have their individual and profound effects on the program. It is easy to analyze the machine trades in terms of major occupational groups based on the different machines used; lathes, shapers, mills, drills, and grinders. The operations and steps required for the operation of these machines are also analyzed and grouped. These groups might serve as the basis for course sequence. There is, however, one outstanding problem. If the class size is 20, few boards of education can afford to buy the 20 lathes or the 20 mills which would be required for all students to be working on the same duties or tasks at the same time. Furthermore, having machines stand idle cannot be justified when the cost of equipment is considered.

Since students in laboratory settings work on different equipment during the same time period, it is also necessary that the instructional grouping of tasks be different from the occupational block in the analysis and that tasks be drawn from any number of occupational blocks to form a grouping. Thus all of the machines are used as students are rotated from one to another and as instruction for a group of duties or tasks is in process. This organization, which by necessity has been followed, is in fact psychologically sound and realistic, because as a student moves toward the goal of a skilled craftsman, the learning experiences become more complex and require that skills and knowledge be drawn from many occupational blocks for their completion.

The organization of groups of duties or tasks for instruction requires, in the case of machine shop, that different levels of skill be determined and the operations on a number of different machines be sequenced for any one group of tasks to be presented in a selected period of time. It is also necessary that, for the purpose of applying principles of learning, similarities in experience be clustered, and that principles of shop practice, science, and mathematics be selected for each group of tasks so as to show the best application of related instruction at the same time.

The program, equipment, and facility variables have already dictated that this instructional group system be employed. When one examines what has been done, however, it can be found that the accomplishments have come most often incidentally and haphazardly rather than from a real plan of organization; and the reason for any success that might have been realized is that with a limited class size one could carry the program by means of individualized instruction. This is all well and good and by no means should the importance of this type of instruction be depreciated. Realistically, however, not even an experienced instructor can carry the subject organization in his head so that the best experiences in learning are brought to the right student at the right time. Time limitations in any program require much group instruction. Furthermore, group instruction has its own intrinsic values.

Before progressing further on the grouping and scheduling of the instructional group, it might be well to state that the values of vocational education as now operated, should in no way be discounted. Vocational education has afforded the opportunity to provide learning situations which are, in fact, real life work activities. The responsibility now becomes one of organizing the practical learning opportunities in a better pattern in order to assure *all* students *instruction* and *experience* in all tasks included in the program.

Lists of behavioral objectives can now probably be purchased for most courses, but in these there seems to be a preponderance of such statements as "The student will be able to recall; the student will be able to list..." An overemphasis on verbal response in other school situations has brought many students into vocational education. The goal is quality of instruction; learning by the "pickup" method cannot be justified in vocational education.

In vocational education, evidence indicates that too many students grow in maturity through real life situations or "moments of truth" to warrant any philosophical change. In course organization, it is well to remember a statement of Rupert Evans in a recent book. He said that the only thing which has really been proven about laws of learning is that, with the exception of the learning of nonsense material, students learn faster and remember what they have learned longer if what they are learning is meaningful to them. It is planned that, through the instructional system design, the elements of the occupation will be presented so as to be even more meaningful.

It cannot be assumed that with the development of an "instructional" system the details of the process will be simplified. A unified instructional pattern is sought as a base for understanding and communication within and between services. It is expected, however, that the differences in services and programs will accomodate the details of student experiences and teacher strategies.

The variables of students, facilities, equipment, materials, and time must be specifically identified and defined when decisions are made concerning the clustering of tasks into major instructional groups, and when these groups are scheduled for instruction and practice within a time frame for management purposes. This will be necessary for the operation of the system.

The abilities and experiences of the learners are the first important considerations. The class size for the total operation and the most practical team size for working groups need to be predicted.

The facilities should include not only space for major equipment and for practice and live work situations, but also adequate storage for real or model units when they are not in use. It is expected that, for the intricate organization of the program, many different strategies will be required. Live work, practice jobs, simulation and other types of learning will of necessity be incorporated so as to provide meaningful experiences for the students. It would be ideal if in all cases the instructional program could dictate the variables, but it is recognized that in some cases the variables, of necessity, condition the program.

Whenever there is controversy on equipment or materials, the best justification is the written educational plan. The amount of time given to the study of various units needs to be decided by both the importance of the units and what is required for the completion of learning. Multiple or repeat experiences may be planned and scheduled for the more difficult or important tasks.

Among the many possible criteria for the selection and organization of instructional groups is the process of frequency charting. This method sequences laboratory tasks so that operations which are most frequently used are the first to be taught. This enables better management for the teaching of more advanced and less frequently used operations on an individual basis. The sequenced course

outline gives consideration to frequency and importance of tasks. Data on such factors will also help with grouping and scheduling for instruction.

The frequency chart may also provide the basis for the preparation of a progress chart in many occupations. This chart further provides a method for monitoring the planned student experiences to assure that all students receive all of the experiences specified in the module, group, or total training plan.

The organization of learning experiences on a production basis is another possibility for management of the variables in a group. There are as many methods as one can draw from his or her experience and imagination. For each occupation, specific plans will be found for applying the instructional system design.

The illustration on page 55 provides an example of a selection of tasks common to several duty areas of auto mechanics as modules within an instructional grouping. The limitations of the physical facilities and equipment indicates that a class of 21 students (assumed size) cannot be taught any one of the tasks listed at the same time. The inclusion of tasks in modules within the instructional grouping must take into consideration not only the physical facilities and equipment, but also the actual service or repair, and the most efficient rotation of student teams among the various tasks or modules. It should be noted that tasks were selected from the duty areas on the basis of simple to complex. It should also be noted that this instructional grouping may well be the first instructional grouping of a two-year auto mechanics program.

In an attempt to illustrate a methodology for grouping a selected portion of an automotive mechanics course of study, the following sample is presented. In order to understand the illustration, the reader must realize that certain facility and instructional program strategy assumptions were made. Two such assumptions include:

1. The basis for occupational skill development activities in the laboratory will be live work.
2. Twenty-one full-time students are enrolled in the class.

Explanation of Duty Grouping Process

From a total course outline, four duty areas, as illustrated on page 55, were grouped to be addressed concurrently within a specified time frame in accordance with assumed available facilities.

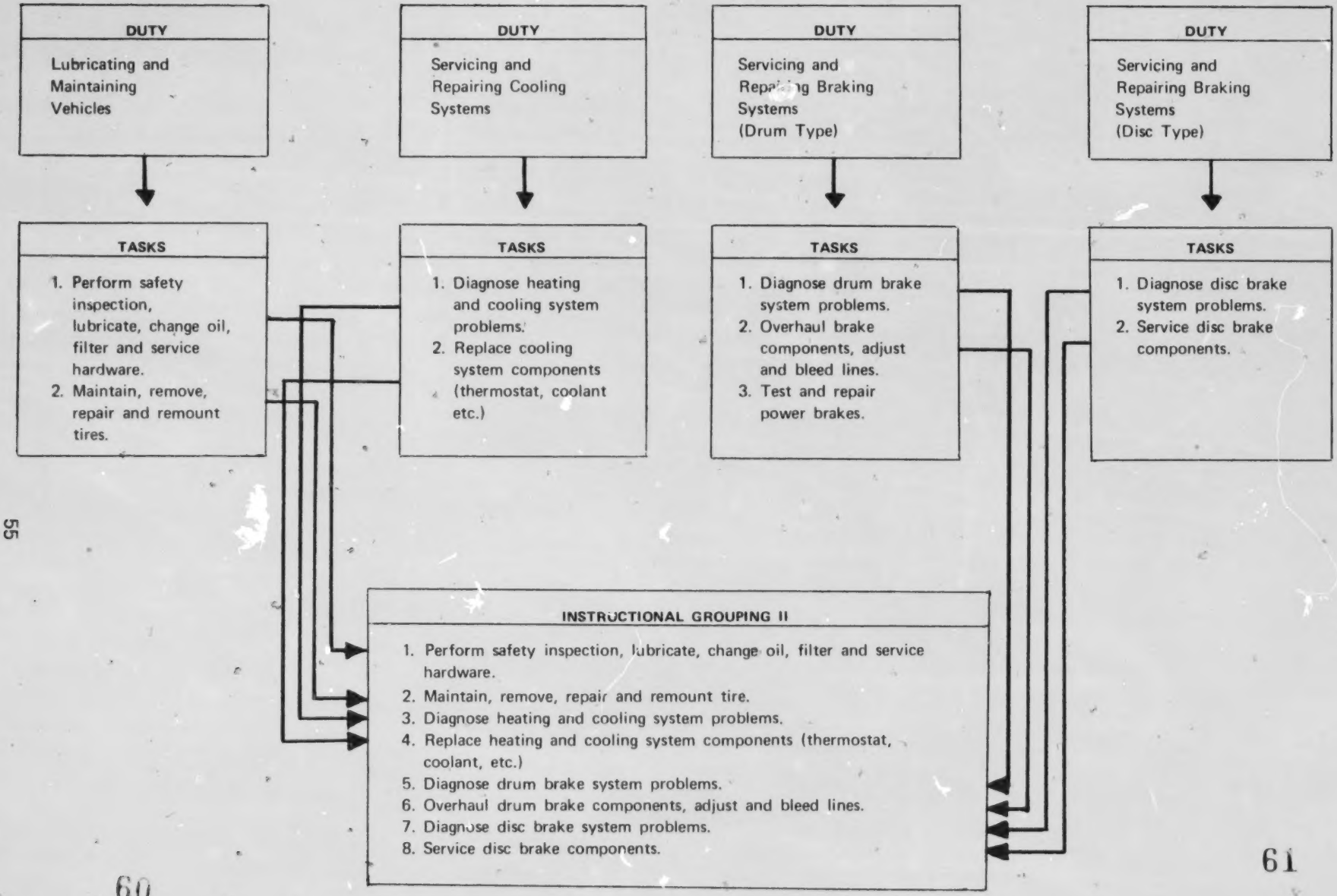
From each duty area a list of tasks was selected which was incorporated into four appropriate instructional groupings around which modularized instructional units could be built.

This particular segment of the automotive mechanics course of study has been planned for a 20-day period of instruction. These 20 days are comprised of four days of instructor demonstrations related to all four modules and sixteen days for actual student practice consisting of four days per module per student team.

In some instances two teams will be involved with the same module simultaneously as can be noted on the rotation schedule chart (Page 56).

DEVELOPING INSTRUCTIONAL GROUPINGS

(A sample component of grouping process)


DUTY
Lubricating and Maintaining Vehicles
DUTY
Servicing and Repairing Cooling Systems
DUTY
Servicing and Repairing Braking Systems (Drum Type)
DUTY
Servicing and Repairing Braking Systems (Disc Type)
TASKS
1. Perform safety inspection, lubricate, change oil, filter and service hardware.
2. Maintain, remove, repair and remount tires.
TASKS
1. Diagnose heating and cooling system problems.
2. Replace cooling system components (thermostat, coolant etc.)
TASKS
1. Diagnose drum brake system problems.
2. Overhaul brake components, adjust and bleed lines.
3. Test and repair power brakes.
TASKS
1. Diagnose disc brake system problems.
2. Service disc brake components.
INSTRUCTIONAL GROUPING II
1. Perform safety inspection, lubricate, change oil, filter and service hardware.
2. Maintain, remove, repair and remount tire.
3. Diagnose heating and cooling system problems.
4. Replace heating and cooling system components (thermostat, coolant, etc.)
5. Diagnose drum brake system problems.
6. Overhaul drum brake components, adjust and bleed lines.
7. Diagnose disc brake system problems.
8. Service disc brake components.

INSTRUCTIONAL GROUPING

ROTATION SCHEDULE

For Class Size - 21
7 Teams 3 Students Each

DAY	MODULE A Perform safety inspection, lubricate fittings, change oil, replace oil filter and service hardware.	MODULE B Maintain, remove and remount tires. Diagnose cooling and heating system problems. Replace cooling and heating system components.	MODULE C Diagnose drum brake system problems. Overhaul drum brake components, adjust and bleed lines.	MODULE D Diagnose disc brake system problems. Service disc brake components.
1	INSTRUCTOR DEMONSTRATIONS			
2				
3				
4				
5	1 & 2	3	4 & 5	6 & 7
6	1 & 2	3	4 & 5	6 & 7
7	1 & 2	3	4 & 5	6 & 7
8	1 & 2	3	4 & 5	6 & 7
9	3	4 & 5	6 & 7	1 & 2
10	3	4 & 5	6 & 7	1 & 2
11	3	4 & 5	6 & 7	1 & 2
12	3	4 & 5	6 & 7	1 & 2
13	4 & 5	6 & 7	1 & 2	3
14	4 & 5	6 & 7	1 & 2	3
15	4 & 5	6 & 7	1 & 2	3
16	4 & 5	6 & 7	1 & 2	3
17	6 & 7	1 & 2	3	4 & 5
18	6 & 7	1 & 2	3	4 & 5
19	6 & 7	1 & 2	3	4 & 5
20	6 & 7	1 & 2	3	4 & 5

Team and Module Configuration

For this particular grouping, tasks will be organized into four learning modules.

Each module will cover a period of four laboratory days and will involve a team of three students during the four day duration. Modules may be offered singularly or in multiples, depending upon the nature of learning activities and available facilities. When multiple modules are planned one must balance the modules so that the contents of each require as nearly as possible the same average amount of time to learn. This will permit relative ease in determining a rotation schedule.

Seven teams of three students each (7 x 3 = 21 students) will rotate through the four modules over a sixteen-day period (4 days per module times 4 modules = sixteen days.) Coupled with the four days allotted for instructor demonstrations, the twenty days initially designated for this instructional grouping will have been consumed.

For illustrative purposes, the tasks which were grouped on the preceding page will have been arranged into learning and practice modules as follows:

MODULE A – Perform safety inspection, lubricate fittings, change oil, replace oil filter, and service hardware.

MODULE B – Maintain, remove, and remount tires; diagnose cooling and heating system problems; replace cooling and heating system components.

MODULE C – Diagnose drum brake system problems; overhaul drum brake components, adjust and bleed lines.

MODULE D – Diagnose disc brake system problems; service disc brake components.

The sample rotation schedule on the following page provides an example of the scheduling of this instructional grouping. It covers the period of time necessary for demonstrations to the total group and for the rotation of the students in teams of three in order that all students will gain experiences in each of the instructional modules. It is recognized that students will need to have additional instruction as they approach each of the modules. The students, however, have had a demonstration on each of the modules and the role of the instructor will be one of review and coaching as the teams rotate through the modules. This is only an example. Different physical facilities, experiences in auto mechanics, or numbers of students within a class may dictate a different pattern of tasks for the instructional grouping. A shorter or longer time may be needed before demonstration or student practice. The purpose has been to illustrate the process to be followed as a part of the instructional systems design.

It can readily be determined that all other tasks to be taught must be grouped in a similar manner. A schedule should be planned for demonstrations and the amount of practice required for each set of modules in each instructional grouping. Vocational areas which have sufficient equipment for all students to gain experience on a similar task at the same time will not be faced with the issue of grouping and scheduling.

The process of selecting tasks for instructional groupings must take into consideration both the frequency and importance of each task in the occupation. Tasks which will be used again and again in the instructional process should be incorporated in the initial phases of the program.

All facilities and equipment available must be used to the best advantage at all times. No item of equipment should remain idle on the theory that certain basic learning must be gained before the students begin to practice on that item of equipment. Each item of equipment probably calls for basic learning tasks that may be considered, even for a beginning student.

The problem of laboratory supervision must also be considered as tasks are selected for an instructional grouping. It should be kept in mind, however, that initial instructional groupings or time schedules can be wrong. Adjustments can be made.

The lack of an organized plan is not justified in a modern vocational education facility. It is important that the systems approach be applied to curriculum development because of its great importance in the education of our youth and consequent impact on social and economic life.

CHAPTER VIII

DETERMINING THE RELATED INSTRUCTIONAL CONTENT

Definition: Content (related technical knowledge) – The cognitive information and technical understanding that a worker needs to perform the manipulative tasks of the occupation and to adjust to changes required in the performance of those tasks by technological developments.

In previous steps proposed in the development of the course of study, it has been indicated that tasks selected for inclusion in the course outline and task scheduling become controlling factors in the organization of the curriculum. In addition to task performance the student needs technical information to understand the tasks and changes which occur in occupational practices, procedures, materials, processes, and products. Representatives from industry and business continue to question vocational education graduates' grasp of principles and content essential to employment and progress in their chosen vocation.

Any program providing instruction to high school youth for entrance into an occupation cannot be considered an educational program if it does not provide the young person with information on the "why" to support the "how" gained in the shop or laboratory. It is not proposed that vocational education become "academic," but it is proposed that a "skilled" person in an occupation cannot be so classed unless he is versed in the technical knowledge, rationale, and background of his vocation. Employers indicate the importance of a knowledge base in addition to skills. The common complaint of employers and joint apprenticeship committees that public school graduates, including those from vocational education, cannot pass their occupationally-related math or science tests indicates the need for greater emphasis on the disciplines related to the occupation.

The majority of high school vocational education programs in Ohio provide time for related technical instruction in addition to instruction in the tasks of an occupation. Such a pattern of instruction is supported by educational theory and principles of learning. Flexibility in the job market of the future will be gained not so much by learning a little bit about many things as by achieving a depth of competency in the skills and technical knowledge of an occupation. Technical knowledge of an occupation should be sufficient to enable the worker to adjust to changes within that occupation.

Scope of Related Instruction

The major thrust of the related technical instruction in vocational education deals with the cognitive learning essential to the occupation. The cognitive learning includes instruction about the skill processes which will hasten the acquisition of skills within the laboratory. Directly related cognitive instruction deals with the planning process and understanding of the theory of operation of any of the units, the relationship of different processes or parts, terminology, nomenclature, sources

of information or data, safety hazards, and other concepts contributing to sound judgment and perceptions within the occupation. The related technical instruction must also include principles from disciplines applied to the occupation. Such disciplines will depend upon the nature of the occupation, since the goal of the instruction is competency in the occupation and not competency within a discipline. Such disciplines may include mathematics, English, physical science, social science, behavioral science, and life sciences such as anatomy, biology, and physiology. The focus must be upon the application of the discipline to the occupation. The goal is to give the learner an understanding of the principles of the related discipline in order that he can understand changes which may come into the occupation as he progresses in employment.

Practices in occupations may change quickly. Principles of science, mathematics, or other disciplines underlying the occupation change much more slowly. An understanding of these principles, therefore, is an essential part of preparation for employment in a changing technological world. Such understandings, however, can be achieved only through their application to meaningful work experiences in the shop or laboratory.

The related technical instruction must also concern itself with affective learning. Vocational education has an obligation in the preparation of youth for employment which goes beyond the provision of skills and technical knowledge. Historically and in practice, vocational education has assumed a concern for the work habits, attitudes, safety judgments, and interpersonal relationships essential for successful employment. Some of the affective areas may be identified within an occupational analysis, such as social behaviors, or essential patterns of interpersonal relationship. Matters of dress, grooming, and language also may be reflected in the analysis. Other important factors in the affective domain, however, may be a function of the method of instruction and the teacher's attitude and class management, rather than a specific item of content. Honesty, acceptance of responsibility, consideration for others, accuracy, dependability, and other qualities commonly desired in a worker fall in this category.

The occupational analysis providing resource information to the person developing a course of study includes an analysis of the following factors as they relate to each task within the occupation:

1. Tools, equipment, materials, objects acted upon
2. Safety – hazard
3. Science
4. Math – number systems
5. Communications
   A. Performance modes
   B. Examples
   C. Skills and concepts

The occupational analysis also includes a breakdown of the performance knowledge, decisions, cues, and errors relating to task performance which can be of assistance in the related classroom.

Chart I (pages 62 - 63) is a general guide for analyzing a task statement within the occupational analysis. Chart II (pages 64 - 65) is a specific example of such a statement for a task within the auto body mechanics occupation.

Procedure for Selecting and Organizing Related Content for Curriculum

Just as the occupational analysis serves as a source document for the identification of tasks to be considered for inclusion in a course outline, it also serves as a source document for the identification of related technical instruction content. The selection of tasks for inclusion in the course of study, the scope and sequencing of the course outline, and the grouping and scheduling of the duties and tasks, plus the written instructional objectives control the identification and scheduling of the related content. The grouping and scheduling of tasks can be the basis for organizing the related content.

As an example, a group of duties and tasks have been allotted four weeks in the organization of a course of study. It would be obvious, therefore, that the related technical instruction content for those tasks should be organized to cover the same period. An approach would be to list the task statement components from the occupational analysis across the top of a page and the days of the week down the left side of a page. An example of a proposed charting form is included as Chart III (page 66). Using this form, a group of tasks scheduled for the time period, and the instructional objectives for the tasks, one could refer to the occupational analysis and develop a plan over the period of instruction and practice for the inclusion of the items of related content to be covered. By inspecting the selected task statements, the written objectives, and the occupational analysis, the instructor can determine the related content that is required for successful task performance. The most critical content in relationship to all of the tasks could be scheduled during the early part of the period; the less important areas should come towards the end.

Such a plan, however, cannot work in the total absence of individualized instruction and the necessary classroom facilities and equipment to make such instruction possible. Individual instruction gives opportunity to impart technical information while the student is working on a specific task. No course of study should be developed in which either the value of group instruction or the value of individual instruction is ignored. To assume, however, that technical knowledge will be provided by individual instruction at precisely the time the student is practicing task-related experiences in the laboratory ignores the actual conditions under which most programs operate.

The related content of some skilled occupations may be of such little quantity and depth that an occupational course of study based upon a "do and know" basis will suffice. In such cases, the technical content may be taught in the laboratory at the work station. In most of the skilled occupations, however, in which there is a significant involvement of principles from disciplines, it is necessary to include a pattern of group instruction which must parallel the sequence of laboratory experiences in terms of tasks or duties. It may not be possible, though, to coordinate classroom instruction with the exact time the student is practicing the skill in the laboratory. It becomes a

CHART I

(TASK STATEMENT) WRITE OUT THE FULL TASK STATEMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
List the tools, equipment, supplies, materials, and references which must be available to and used by the worker during task performance. Identify the people who will be involved in the task other than the worker, such as clients, patients, assistant, supervisor.	STEPS List the critical steps and procedures that a worker follows in performing the task. List the steps in their routine sequence. List all steps and procedures which require special skills.	List the key safety rules that must be followed for safe task performance. Identify the types of hazards that exist in the task environment. Identify the type of injury or damage which can result from unsafe performance.
DECISIONS List any decisions that a worker makes while performing the task. Check the steps listed above to identify possible choices that must be made and that require job knowledge. 68	**CUES** List any sign, signals, or variables the worker takes into consideration when making the listed decisions. List cues which are standard routine elements but which require the worker to be aware of their existance.	**ERRORS** List any errors or failures which result from improper decisions. Identify the failure conditions that a worker must be able to recognize. 69

(TASK STATEMENT) WRITE OUT THE FULL TASK STATEMENT

SCIENCE	MATH – NUMBER SYSTEMS
Identify the principles, rules, concepts and/or generalizations of science that apply to task performance. List the key concepts, rather than detailed facts, which must be understood by a successful worker. Consider both the natural sciences and the social or behavioral sciences related to the task.	Identify math skill or function which is applied during the task performance. Give a specific example of what is actually done by the worker using the listed math skill. e.g., Addition = total invoice charges. Identify the mathematical ideas and concepts that must be understood for efficient task performance.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Identify each basic type of communication that takes place during the task performance.	List a specific example of how each communication mode is involved in the tasks.	List the basic communication skills needed to accomplish each mode of communication. Identify the concepts and rules of communication that must be understood for efficient task performance.

70

71

CHART II

B_{12} (TASK STATEMENT) REFINISH WITH ACRYLIC ENAMEL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Bucket, sponge, car soap Wax remover chemical Toweling and rags Masking tape and paper Metal conditioner Primer surfacer Sandpaper and disks Blow gun and tack rag Glazing putty Lacquer thinner and enamel reducer Sealer Spray guns Acrylic enamel Spray booth Power sander Air hose Car	Wash and dewax car Featheredge broken areas Treat bare metal with metal conditioner Mask all surfaces not to be painted Prime all featheredged areas Apply glaze putty Sand entire automobile Remove sanding sludge with water Wash sanded surface with chemical Blow and tack Apply sealer Blow and tack again Apply acrylic enamel reduced in accordance with label directions Unmask and clean up	Eye protection - eye injury Observe standard safety rules for all power equipment and compressed air Spray booth - fire, dirt in finish Spray respirator - breathing vapors Thinners and reducers are inflammable - fire
DECISIONS	**CUES**	**ERRORS**
Type of thinner and reducer Type of sealer Amount of material	Weather temperature Color of automobile Size of automobile	Orange peel or runs and sags Poor coverage Insufficient material
72		73

B_{12} (TASK STATEMENT) REFINISH WITH ACRYLIC ENAMEL

SCIENCE	MATH – NUMBER SYSTEMS
Fluids under pressure [atomization and compressed air] Centrifugal forces developed by bodies in rotation [operating power sanders] Effects of friction on work processes and product quality [friction while sanding] [humidity/temperature] Behavioral Science (see index)	Ratio and proportion, estimate [ratios - paint and materials] Ratio and proportion, estimate [reduce metal conditioner] Use of numbers (without calculations) [grit and dimensions]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Label directions Shop manuals	Comprehension, detail/inference, informational reports, recommendation reports, description of mechanisms, definition, terminology
Speaking	Shop foreman Peer group	Terminology/general vocabulary, clarity of expression, logic
Feeling	Level areas	Shape, depth, consistency, texture

74 75

CHART III

PLANNING SHEET
RELATED TECHNICAL INSTRUCTION

_____ of _____ Sheets

Course of Study _____
Group _____

WEEK DAY	TOOLS/ EQUIPMENT	SAFETY HAZARDS	SCIENCE	MATH	COMMUNICATIONS: PERFORMANCE MODES	COMMUNICATIONS: EXAMPLES	COMMUNICATIONS: SKILLS/ CONCEPTS
1							
2							
3							
4							
5							
99							

problem, therefore, for the teacher to select from the occupational analysis those things that are most critical for the students at the early part of the period allotted to a group of tasks or duties. They may even be selecting items relating to tasks which will be performed later in that sequence.

A sample schedule of related technical instruction for an instructional grouping is indicated in Chart IV (pages 68 – 71). Auto mechanics tasks included in the example of grouping and scheduling in the preceding chapter were used as the basis for this example, along with the time line for the instructional demonstrations and student practice of tasks. Four days were planned for the demonstrations; a total of 16 additional days were required for all students to gain practice on the modules of the instructional grouping. Such a schedule then provides a total of 20 days for related technical instruction when it is offered in a classroom pattern of 1½ hours per day in addition to the three hours of laboratory.

To develop the related technical instruction schedule, an instructor first identifies the tasks in the instructional grouping; second, selects the appropriate tasks from the occupational analysis which enumerates performance patterns and related content for that task; third, reviews the items of instruction included on all of the analysis sheets for the tasks included in the instructional grouping, deletes those topics which duplicate each other, or which have been taught previously, and those which he determines are not important to the objectives of the instruction; and then schedules the remaining items of technical content, along with any items from the performance knowledge which he wishes to teach in the related instruction classroom, over the 20-day period in which the instructional grouping will be covered in the shop or laboratory. The instructor may copy the items of related technical instruction from the occupational analysis sheets on to a work sheet or he may cut out the topics and paste them on such a work sheet. In addition, the instructor may wish to add a review of preceding instruction or some topics that will be needed in future instructional groupings to the topics related directly to the tasks being taught within the shop or laboratory. For example, it might be necessary to build certain math skills and understandings prior to the time that these concepts would be needed to master a more advanced skill in an occupation.

After the topics for related technical instruction and the appropriate time have been determined, the final course of study can display the content vertically or in any other manner desired, but the relationship of the content to a timeline is still necessary.

Vocational education is not a discipline. It is a program designed to assist a person to become employable. Those occupations which can be classed as skilled occupations involve more than psychomotor activity, and even the semi-skilled and low-skilled occupations require some technical knowledge. The ability to accomplish a task in an occupation is enhanced by an understanding of the principles of the disciplines which apply to the practical problems the worker faces in the occupation. Related technical instruction provides the "why" behind the "how" of a skill and enables one to interpret and adapt to new developments, materials, processes, and products that affect his chosen occupation. A course of study needs to reflect the selection and organization of the related technical content if a quality program of instruction is to be maintained.

CHART IV

PLANNING SHEET
RELATED TECHNICAL INSTRUCTION

Course of Study Auto Mechanics
Group II Week 1

WEEK DAY	TOOLS/ EQUIPMENT	SAFETY HAZARDS	SCIENCE	MATH	COMMUNICATIONS: PERFORMANCE MODES	COMMUNICATIONS: EXAMPLES	COMMUNICATIONS: SKILLS/ CONCEPTS
1		Safety Inspection, Lube, Tires, Etc. Wear safety glasses Do not remove radiator cap if engine is hot Foreign material may get into eyes Would get burned from steam pressure Proper use of tools Hands, hair, loose clothing could catch in moving parts			Reading Writing	Safety Inspection, Lube, Tires, Etc. Check lube and oil charts Fill in PM report Customer complaint Charts - tire pressure size	Safety Inspection, Lube, Tires, Etc. Terminology
2	Diagnose Cooling and Heating System Problems Belts — Heater core Fan — Freeze Plugs Hoses — S.T.K. Radiator — Pressure tester	Diagnose Heating and Cooling System Problems Wear safety glasses Make sure engine is off and will not start Do not remove radiator cap if engine is hot Foreign material or steam could get in eyes Hands, hair, loose clothing could catch in moving parts Would get burned by steam pressure			Speaking Reading	Diagnose Heating and Cooling Problems Customer complaint Chart, Hydrometer	Diagnose Heating & Cooling System Problems Terminology Logic Gestures
3	Diagnose Drum Brake System Problems Dynomometer Brake pressure bleeder Brake drum Brake shoes Park brake cables and levers Lines and hoses Wheel and master cylinders Spring and brake linkeage	Diagnose Drum Brake System Problems Wear safety glasses Keep brake fluid off hands and body Support car on safety stands Keep foreign material out of eyes Brake fluid causes irritation Hydraulic jacks are not safe			Speaking Reading	Diagnose Drum Brake System Problems Customer Information Spec. charts	Diagnose Drum Brake System Problems Terminology Logic
4	Diagnose Disc Brake System Problems Dynomometer S.T.K. Brake tool kit Calipers Pads Rotors Control valves Front wheel bearings	Diagnose Disc Brake System Problems Wear safety glasses Observe safety rules in use of dynomometer Use sound judgment on performance test Foreign objects High speed or power operation Possible poor braking conditions			Speaking Reading	Diagnose Disc Brake System Problems Customer information Spec. charts	Diagnose Disc Brake System Problems Terminology Logic
5	79				Listening Viewing Touching	Diagnose Cooling and Heating System Problems Auditory discrimination Logic Visual analysis Temperature	Diagnose Cooling & Heating System Problems Boiling sounds Visual signs, leaks, etc. Overheat

80

CHART IV (CON'T)

PLANNING SHEET
RELATED TECHNICAL INSTRUCTION

Course of Study Auto Mechanics
Group II Week II

WEEK DAY	TOOLS/ EQUIPMENT	SAFETY/ HAZARDS	SCIENCE	MATH	COMMUNICATIONS: PERFOR– MANCE MODES	COMMUNICATIONS: EXAMPLES	COMMUNICATIONS: SKILLS/ CONCEPTS
6				Metric and English measure and conversion Measurement: Geometric volume, non-geometric liquid Reading and interpreting tables, charts and graphs Logs	Diagnose Brake System Problems Listening Touching Smelling	Diagnose Brake System Problems Grinding, squeaks, squeals, scraping Fluid leaks, seepage Heat Fluid odor, burning brake lining	Diagnose Brake System Problems Auditory discrimination Logic Size Shape Temperature Odor burning brake lining
7			Dependability On time Regularity Accuracy of repair	Set of real numbers Rationals	Tires Viewing Touching	Tires Abnormal wear patterns Rough tread or lumps, or featheredging	Tires Visual analysis Logic Symbols and codes Shape
8			Image Personal appearance Conduct Trade	Fundamental Operations (Calculation) Addition algorithm			
9			Cooperative venture Working together Encouragement Seek help of others (specialist) Housekeeping	Subtraction Algorithm			
10	81		Respect For others For tools and equipment, etc.	Ratio and proportion (coolant solution) Reading and interpreting tables, charts, and graphs Logs (coolant mixing chart) Instruments: pressure tester, hydrometer Basic Arithmetic skills and concepts			82

CHART IV (CONT.)

PLANNING SHEET
RELATED TECHNICAL INSTRUCTION

Course of Study Auto Mechanics
Group II Week III

WEEK DAY	TOOLS/ EQUIPMENT	SAFETY HAZARDS	SCIENCE	MATH	COMMUNICATIONS: PERFORMANCE MODES	COMMUNICATIONS: EXAMPLES	COMMUNICATIONS: SKILLS/ CONCEPTS
11					Writing	Report condition, repairs and cost	Penmanship Spelling Reports
12			Simple machines used to gain mechanical advantage. Fan belts and pulleys.		Writing	Report condition, repairs and cost	Penmanship Spelling Reports
13			Fluids under pressure. Pressure caps Centrifugal forces developed by bodies in rotation - Water pump Resistance of materials to change in shape. Fan belts and hoses.		Writing	Report condition, repairs and cost	Penmanship Spelling Reports
14			Engine oils Lube		Writing	Report condition, repairs and cost	Penmanship Spelling Reports
15			Fan belts Oil pump Tire changer Wheel wrench Tire Road friction Tire body		Writing	Report condition, repairs and cost	Penmanship Spelling Reports
	83						84

CHART IV (CON'T)

PLANNING SHEET
RELATED TECHNICAL INSTRUCTION

Course of Study Auto Mechanics
Group II Week IV

WEEK DAY	TOOLS/ EQUIPMENT	SAFETY/ HAZARDS	SCIENCE	MATH	COMMUNICATIONS: PERFOR-MANCE MODES	COMMUNICATIONS: EXAMPLES	COMMUNICATIONS: SKILLS/ CONCEPTS
16			Loyalty To peers Customers Company	Basic Algebra Skills and Concepts Manipulation of formulae (for every one pound) pressure, 3° rise) Substitute given values order to find the value of the required unknown (in boiling point)			
17			Simple machines used to gain mechanical advantage: Levers Work input, work output, friction and efficiency in simple machines Parking brake cables				
18			Effects of heating and cooling on expansion of materials: Brake fade; Fluids under pressure. Master cylinder and wheel cylinder; Transfer of heat from one body to another Lining to drum; Effects of friction on work processes and product quality - brake fade				
19			Fluids under pressure - Master cylinder and calipers Transfer of heat from one body to another. Pad to rotor				
20	85		Professionalism Personality conflicts Communications				86

CHAPTER IX

DETERMINING EVALUATION STRATEGIES

Definitions: Evaluation strategies – Methods of determining the success of the instructional process, including the necessary planning to insure the accurate appraisal of learner achievement in relationship to behavioral objectives.

Formative evaluation – An appraisal process designed to determine if a student is progressing satisfactorily; if, in fact, he understands what is being presented.

Intermediate summative evaluation – Evaluation that takes place between the formative and summative stages. It evaluates progress of a student at the end of major units of instruction.

Summative evaluation – An appraisal process designed to determine how well the student has met the behavioral objectives.

The Relation Between Instruction and Evaluation

Teachers can evaluate their own work at five key points, as shown in the following table. Their evaluation methods can range from the informal and intuitive to the formal and empirical at any one of the five points.

	INSTRUCTION	EVALUATION
1.	Set objectives	Evaluate Objectives (Objectives Evaluation)
2.	Design and sequence lessons	Evaluate instructional design (Design Evaluation)
3.	Place students in sequence of lessons	Evaluate entering students (Diagnostic Evaluation)
4.	Begin instruction and modify teaching as necessary	Evaluate immediate effects (Formative Evaluation)
5.	Determine student competence on related series of tasks	Evaluate retention and competence in completing related tasks (Intermediate Summative Evaluation)
6.	Complete instruction and reselect students as necessary	Evaluate final effects of course (Summative Evaluation)

Both formative and summative evaluation have application in a vocational education program. Such evaluative measures must be clearly understood, however, both in terms of their purpose and their place in the instructional process if they are to be effective.

Formative evaluation provides immediate feedback that allows the teacher to modify or shape or form the teaching even as he or she performs it. It is a process that can be employed to determine if the students are pointed in the right direction; if, in fact, they understand what is being presented during the presentation phase. Thus, due to the "immediacy" characteristic of formative evaluation, it is most appropriately used in conjunction with the daily teaching process and should not be a distinctive part of a course of study. It is, however, an important dimension of the evaluative process and must not be overlooked.

Summative evaluation is a means of measuring the degree of accomplishment or achievement on the student's part. In vocational education summative evaluation has application in both the laboratory and related instruction activities. Summative evaluation may come about in the form of intermediate summative evaluations as it relates to a task or tasks that are components of a larger duty area. For example, intermediate summative evaluation in related instruction could relate to assessing the cognitive domain relative to individual tasks involved in making proper journal entries in an accounting program.

Intermediate summative evaluation may also apply to actual manipulative or psychomotor activities in the laboratory experiences that are individual task oriented.

On the other hand, summative evaluation is applicable to the total duty or group activity to determine if the student can actually assimilate the various tasks into the performance of the duty area. Building upon the previous accounting example, a summative evaluation would be to have a student actually balance a journal account through performing the various tasks or functions required to arrive at such a balance.

Intermediate summative and summative evaluation should be determined and built into a course of study format. Such evaluative measures will facilitate planning and procedures in the actual development and use of the course of study document. A recommended evaluation design process that could be employed by vocational teachers as a part of the ISD is described in the following paragraph:

Set objectives. The teacher starts by imagining what the students should be able to think, feel, or do at the end of the course. The teacher imagines under what *conditions,* at what *speed,* and with what *accuracy* the students should be able to do it. The teacher writes the objectives so clearly that the students in his class, the teacher himself, and even an outside observer would have no difficulty in knowing exactly what they mean.

Evaluate objectives (objectives evaluation). The objectives themselves should be evaluated, strange as this may sound at first.

Objectives should be evaluated to determine whether they are worth teaching. Obviously, this must be done before the course begins. It should be done by an outside, independent source which can confirm the teacher's own judgment about what subject content and student behaviors are worth teaching. The objectives can be evaluated by such techniques as having them reviewed by a panel of experts in the occupational field, by having them examined by a group of employers, or by comparing them to an up-to-date description of what workers actually do today (and presumably will be required to do tomorrow) in the occupation.

Objectives should also be evaluated to determine whether they are stated clearly enough to be measured. Two independent judges – such as a pair of classroom teachers – should be able to agree easily on whether students at the end of the course can do what the teacher had in mind. In fact, the two judges should be able to design separate final exams for the course which would be equally acceptable to the teacher.

Design and sequence lessons. The teacher must first decide in what order to teach the objectives. Then the teacher must design the lessons so that the student participates actively in the learning process, moves successfully from step to step, and is rewarded continually for his or her successes.

Evaluate instructional design (design evaluation). By evaluating the instructional design before the course is actually taught, teachers can prevent wasting their own time and the students' time with ineffective methods and materials.

The teacher can perform the evaluation or can have it done by outsiders. The outsiders might be one or two experienced, skillful classroom teachers who have the detachment to offer an independent judgment of what the teacher has designed, a specialist in what is called instructional development (the scientific design of instructional sequences), or an educational psychologist who knows the best conditions for producing learning.

In any case, the instructional design ought to be examined against a list of good conditions for student learning. There are at least 25 such conditions. Here is a short, incomplete list:

–A person learns only the behaviors which he or she produces.
–A person must know what new behavior he or she is to learn.
–A person must receive information about the quality of his or her own performance.
–A person learns through many senses – auditory, visual, kinesthetic, tactile.
–Time for practice is essential.

Place students in sequence of lessons. Entering students are not at the same point when they begin a course. Some will not even have learned the prerequisites; others will be ready to begin the first lesson; yet others could make a fair score on the final exam on the day they begin the course. The teacher must determine what point each student has reached in order to schedule him into the sequence.

Evaluate entering students (diagnostic evaluation). The teacher must find out what students already know, what they are able to learn, and how fast they can move. Such information will indicate what kind of orientation and special preparation are necessary for individual students or the class as a whole. Only then can the course begin.

The teacher can get this information by examining records of students achievement in previous courses; by looking over students' general ability, achievement, aptitude, and interest test scores; by administering placement tests to students; by interviewing them; by giving them trial exercises, and observing their work; and by many other means.

Teachers naturally accumulate this kind of information about students as the course proceeds, but they can make instruction more efficient and more satisfying for students if they collect it in advance and use it to place students in the sequence of lessons.

Begin instruction and modify teaching as necessary. Instruction takes place over time, giving the teacher an opportunity to change his or her approach if it does not prove effective.

The changes are made easier by the fact that the instruction methods and the materials have been broken down into smaller units than an entire course, grade, or program. Each of these small units is designed to produce learning over a short period of time — a day, a week, or a month.

Evaluate immediate effects of teaching (formative evaluation). The teacher can evaluate student learning unit by unit, segment by segment, as it occurs, without waiting for the end of the course. Because such student evaluation during the course provides immediate feedback that allows the teacher to modify or shape the teaching even as he or she performs it, the process is called formative evaluation.

The specific learning objectives associated with each segment of instruction guide formative evaluation. Properly used, formative evaluation can show how well each segment is being learned, show what is left to be learned, and guide decisions about alternative ways of teaching. The great power of formative evaluation — evaluation during the formation of learning — is that it can help insure that learning will occur.

In most cases, the teacher will have to act as his own formative evaluator, collecting and judging data as a part of the normal teaching day. But in other cases the teacher may call upon selected students, other teachers, employers, or workers.

Once again, it is important to emphasize that the evaluation processes, as just reviewed are not presented as a means for determining student failure, but if applied in a timely and carefully selective manner, such processes can go a long way in assuring student success because of the built-in opportunity for review, modification and re-direction on the part of the instructor.

CHAPTER X

OUTLINE OF PROCEDURE FOR THE DEVELOPMENT OF A COURSE OF STUDY

The preceding chapters in this manual have dealt with content of a course of study. Within each chapter, the procedures for developing that section of the course of study are implied, but the specific steps are not clearly delineated. This chapter presents in outline form the development of a course of study following the instructional systems design pattern. In cases where the bare outline does not provide sufficient information, the reader can refer back to the individual chapter relating to the topic of concern. The course of study developed following the procedure outline will provide a basis for approval of the content by the board of education; for evaluation and monitoring of the instructional program by educational leadership; and for the teacher in determining what is to be taught, how it is to be taught, when it is to be taught, in what order, with what resources, and to what level of achievement. Any instructional activity within a shop, laboratory, or related classroom should be explainable in terms of the course of study and its goal – enabling students enrolled to reach a job objective.

I. PRODUCE THE OCCUPATIONAL ANALYSIS

A. *Definition:* Occupational Analysis – A process that examines an occupation and lists the performance skills and knowledges which are required of the occupation.

B. *Procedure:*

1. Specify the role
   a. work behavior
   b. non-work behavior

2. Identify and verify the tasks in the specified role through:
   a. job description
   b. interviews
   c. task observation of expert performance
   d. task inventory
   e. task survey

3. Analyze the tasks; identify task requirements
   a. performance steps
   b. technical skills and knowledges
   c. behavioral attitude
   d. safety

e. divisions
f. mathematics principles
g. science principles
h. communication skills

II. DEVELOP THE COURSE OUTLINE

A. *Definition:* Course Outline – A list of tasks which are selected to be taught in the local program. This list is selected by the local supervisor, instructor, and advisory committee after studying occupational data and information.

B. *Procedure:*

1. Select and list tasks to be taught
   a. Prepare from the occupational analysis or analyses which apply to the particular program the list of tasks included.
   b. Complete an occupational task survey with business and industry in the local community to determine:
      (1) frequency of workers performing each task
      (2) percent of workers performing each task
      (3) and any other pertinent information
   c. Add topics to cover personal development, human relations, and career information.
   d. Submit the lists of tasks with added survey information to the advisory committee for decisions on those tasks which will be included in the program. Additional factors for consideration in these decisions include:
      (1) entry level requirements of the occupation
      (2) time limits of the program
      (3) facilities available or projected
      (4) equipment available or projected
         (a) possibilities for work stations
         (b) possibilities for live work, mock-ups, or simulations
         (c) possibilities for "out of school" community resources
      (5) budget available or projected
         (a) materials
         (b) supplies
      (6) target population

2. Finalize the list of tasks to be taught in each year of the program.

3. Submit to the school administrative officers for review.

III. PREPARE THE INSTRUCTIONAL PROGRAM OBJECTIVES

A. *Definitions:*

1. Instructional Objective – A description of the performance you want students to exhibit before you consider them competent.

2. Program Objective – Broad program outcomes, that in total provide a broad overview of the entire program. They establish the program parameters, and provide a broad basis for evaluation.

3. Module Objective – More specific than program objectives and include statements addressing each competency covered in the module.

4. Task Objective – Relate to a given task which is a component of the module.

B. *Rationale:*

There must be measurable attributes observable in graduates of a program or it is impossible to determine whether or not the program is meeting the objectives. Without clearly defined instructional objectives it is impossible to evaluate a course effectively and there is no sound basis for selecting appropriate materials, content, or methods.

C. *Structure of Objectives:*

1. Outcome – what is to be achieved

2. Level of achievement – standards or criteria to determine how well it is to be achieved

3. Conditions of performance – under what conditions it is to be achieved

D. *Classification of Objectives:*

1. Affective domain – includes values, attitudes and feelings

2. Psychomotor or skill domain – includes manipulation of materials and objects

3. Cognitive or knowledge domain – includes mental or intellectual abilities

4. Perceptual domain – a nondocumented area in the classification of objectives. The perceptual domain includes objectives that refer to utilizing the senses in analyzing diagnosing problem situations.

E. *Procedure:*

1. Examine program philosophy

2. Prepare overall program objectives

3. Examine instructional groups

4. Organize modules within the instructional groups

5. Prepare module performance objectives

IV. DETERMINE AND STATE INSTRUCTIONAL PROGRAM STRATEGIES

A. *Definition:* Instructional Strategies – Methods of planning, organizing, manipulating, and integrating facilities, equipment, instructional aids, materials, time, and students within the limits of school policy for the purpose of teaching tasks and related content.

B. *Strategies to be Considered:*

1. Establish the type of curriculum organization
   a. subject centered
   b. correlated
   c. integrated
   d. core – Vocational education lends itself well to the establishment of a core curriculum in which the occupational goal of the student becomes the center point for the program and all the skills, technical knowledge, discipline, related instruction, and development of work habits and attitudes are included within the curriculum pattern.

2. Determine the basic method to be used for presentation of the psychomotor or task-oriented part of the curriculum.
   a. practice on real jobs
   b. practice on models
   c. simulation
   d. combination

3. Decide whether students will receive demonstrations on each of the tasks in terms of the total class, small groups, or individuals, or whether students will receive instruction only on a coaching basis.

4. Determine the order of approach – what order the tasks will be taught – simple to complex, known to unknown, job order, parts to whole, whole to parts, or an order based on frequency of performance.

5. Decide, depending on facilities, whether all students will be instructed on the same task at the same time or if it will be necessary to combine the youth into teams and to rotate these teams through a number of tasks during one time frame.

6. Determine the source for practical work and/or simulation materials that will be the basis for instruction and practice.
   a. support and limitations of existing facilities
   b. nature of the occupation
   c. procedure for obtaining practical work as needed in the instructional order

7. Determine the place, amount and procedures for "production," in which all or many students work toward the completion of an end product, as compared with "student work" in which each student carries to completion his own project.

8. Determine to what extent and how the related technology will be correlated with the tasks of the occupation – assignment of one teacher for both the laboratory and related classes or different teachers for each.

9. Decide on tools for student use – will all tools be furnished by the school and kept at a central point for use or will students be required to purchase a set of basic tools for their own individual use?

10. Decide on a plan for obtaining special parts and supplies.
    a. delivery procedures
    b. accounting procedures

11. Determine procedures for formative and summative evaluation.

V. SEQUENCE THE CONTENT

A. *Definitions:*

1. Scope – The depth and breadth of the task and instructional content to be taught in a particular course.

2. Sequencing – The process by which learning experiences are structured to provide the most learning in the shortest time; arranging tasks in the most appropriate order for effective learning.

B. *Factors That May be Considered in Arriving at the Scope of the Course:*

1. Sequence for early need – The experience of some steps or tasks must be provided early so that other selected and assigned tasks can be accomplished.

2. Sequence on the basis of normal business or industrial operation – Many specific steps or tasks must be accomplished in a specific sequence so that a product or service can be completed.

3. Sequence for frequency of use – The most frequently used steps or tasks should be taught first so they can be applied in a multiplicity of student experience without the necessity of individualized instruction.

4. Sequence from the simple to the complex – An application of the laws of learning.

C. *Procedure for Sequencing Course Outline:*

1. Sequence duties
   a. consider seasonal factors
      Examples: Planting and sales – horticulture, turf, poinsettias for Christmas season
      Auto mechanics – live work on cooling systems just prior to winter season

2. Sequence tasks on basis of student readiness.
   a. consider complex test equipment which should be taught in later stages of simple-to-complex sequence.
      Example: white room test equipment in diesel mechanics

3. Sequence within tasks in the following cases:
   a. steps which must be taught early so they can be used with other tasks to follow
   b. steps which follow normal business or industrial procedure
   c. most frequently used steps early in the program

VI. GROUP AND SCHEDULE THE INSTRUCTIONAL PROGRAM

A. *Definitions:*

1. Group – A series of tasks or modules grouped together for instructional purposes and placed in a general time frame.

2. Schedule – A timed plan for a procedure or project.

3. Module – A subdivision of a group of tasks or competencies, composed of lessons taught in close sequence.

B. *Factors to be Considered in Grouping:*

1. Number of students
2. Facilities
3. Equipment
4. Materials
5. Time
6. Subject content

C. *General Concepts on Grouping:*

1. Grouping is necessary when the cost of equipment precludes its use on an individual or student pair basis. Thus, the rotation of student teams is required during a given time frame.
2. A group of duties and tasks provides a timeline which can be used as the basis for the organization of related instruction content.
3. Grouping is a process of synthesis accomplished as a strategy in instruction. It should be distinguished from blocking, which is generally considered to be a part of the thought process in analyzing an occupation.
4. Although most often the group will consist of a number of tasks from the same duty, it is not confined to that organization. It can consist of a group of modules within a task, or tasks can be drawn from different duties to compose the group.
5. It should not be interpreted that grouping is necessary or expected in all occupational areas, nor that grouping is necessary or expected for the total instructional program in any one occupational area.
6. Grouping can apply a variety of equipment types and associated instruction strategies such as practice activities, live work, production projects, learning centers, learning activity packages, simulations.
7. When groups are organized, a time period should be allotted in the laboratory for instructor demonstrations.
8. It should be planned that the small group team activity should be a quality learning experience. Busy work should not be included for the purpose of maintaining the group organization.

9. The complexity of group organization requires diligence in scheduling.

10. Grouping should be such that all students are engaged in an educationally planned and instructive experience at all times, either in observing the instructor demonstration or actively participating in the small team effort.

D. *Procedures for Grouping:*

1. Consider available laboratory space and equipment and determine which student experiences can be grouped so that each student can have each experience on a rotational basis.

2. Examine the tasks in each duty; judge sequence levels of tasks which must be grouped and select combinations of tasks for groups which are as nearly as possible closely associated in the sequential order.

3. Identify equipment and procedures for work stations within groups.

4. Determine from the plans for the total year the days that can be allotted to each group.

5. Decide on the number of work stations which are reasonable for each group.

6. Estimate the time required for completing the work at each work station.

7. Determine the number of students that can be accommodated on a team at each work station at the same time.

8. Determine the number of students required for each team to rotate all students through the tasks within the allotted time.

9. Balance work station time by combining tasks for a team, including shop management duties or review experiences.

10. Estimate days for instructor demonstration.

11. Sequence the groups into the year's schedule.

E. *Scheduling Procedures:*

1. Estimate time required for the experience of each module.

2. Estimate time required for the experience of each group.

3. Match modules within groups so that short-term modules can combine to interface with a long-term module.

4. Chart the modules for a rotation plan of student teams or individual students through work stations, learning experience centers, or learning activity packages.

5. Establish timelines relative to:
   a. school day divisions
   b. total length of school year and vocational program

VII. ORGANIZE THE RELATED INSTRUCTIONAL CONTENT

A. *Definition:* Related Instructional Content (Related Technical Knowledge) – The information and understanding that a worker needs related to the manipulative tasks of the occupation.

B. *Scope of Related Instruction:*

1. Cognitive learning
   a. skill processes
   b. planning
   c. theory of operation
   d. relationship of processes or parts
   e. terminology – nomenclature
   f. safety – hazards
   g. judgment – perceptions
   h. mathematics – science

2. Affective learning
   a. work habits
   b. attitudes
   c. safety judgments
   d. interpersonal relationships
   e. dress, grooming, language
   f. honesty, responsibility, accuracy, dependability

C. *The Occupational Analysis is the Source for Related Content*

D. *Laboratory Grouping is the Basis for Related Content Timeline Determinations*

E. *Procedure for Selecting and Organizing Related Content:*

1. Examine group content and timelines.

2. Select related content from the occupational analysis to correlate with the groups.

3. Judge content and select that which should be taught first and in sequence to meet the needs of all or most students while they work on different modules or tasks in the laboratory.

4. Chart the content to fit group timelines. Use planning sheet for daily related technical content.

VIII. DEVELOP EVALUATION STRATEGIES

A. *Definitions:*

1. Evaluation Strategies – Methods of determining the success of an instructional process, including the necessary planning to insure the accurate appraisal of learner achievement in relation to behavioral objectives.

2. Formative Evaluation – An appraisal process designed to determine if a student is progressing satisfactorily; if, in fact, he understands what is being presented.

3. Intermediate Summative Evaluation – The evaluation that takes place between the formative and summative stages. It evaluates progress of students at the end of major units of instruction.

4. Summative Evaluation – An appraisal process designed to determine how well the student has met the behavioral objectives.

APPENDIX

OHIO DIVISION OF VOCATIONAL EDUCATION
DEFINITIONS OF CURRICULUM TERMS

The following terms have been defined in order to facilitate communications and understanding in the curriculum development process. In most instances, terms are defined according to present-day authorities. In some cases, however, new terms have been popularized in conjunction with the current curriculum development thrust and, where applicable, a former term which has been replaced by a new term appears in parentheses following the new term.

1. *Activity* – A very specific level in the hierarchy of a job. The activity is the smallest aspect of a skill, i.e., Job-Task-Step-*Activity.*

2. *Affective Domain* – An area in the classification of objectives. The affective domain includes objectives that refer to values, attitudes, feelings and emotions.

3. *Behavioral Objectives* – A statement of instructional goals expressed in observable and measurable terms. Such a statement includes the behavior, the conditions, and the standard of acceptable performance.

4. *Cognitive Domain* – An area in the classification of objectives. The cognitive domain includes objectives that refer to mental and intellectual abilities.

5. *Course Outline* – A topical listing of the content of a specific course.

6. *Course of Study* – A comprehensive and detailed plan which shows the scope and sequence of content, and the organization and management of all instructional activities for a specific course in the curriculum.

7. *Cue* – A term used in Occupational Analysis. The signal or information which supplies the necessary data on which to make a decision.

8. *Curriculum* – An orderly arrangement of integrated subjects, activities and experiences which students pursue for the attainment of a specific educational goal.

9. *Decision* – A term used in Occupational Analysis. Any part of a task which calls for a choice to be made.

10. *Duty* – (Block) – A large segment of an occupation made up of related tasks.

11. *Evaluation Strategies* – Methods of determining the success of an instructional process including the necessary planning to insure the accurate appraisal of learner achievement in relation to behavioral objectives.

12. *Formative Evaluation* – An appraisal process designed to determine if a student is progressing satisfactorily; if, in fact, he understands what is being presented during the presentation/demonstration phase.

13. *Grouping* – A series of tasks grouped together, organized for instructional purposes, and placed in a general time frame.

14. *Instructional Methodology* – The principles, methods and techniques for conducting the instructional process.

15. *Instructional Sequence* – The order in which instructional content is carried out.

16. *Instructional System* – An integrated combination of resources (students, instructors, materials, equipment, facilities, content and time), techniques, and procedures arranged in such a manner to assure the effective and efficient achievement of specified objectives.

17. *Job* – The composite of tasks or competencies which comprise the manipulative activities performed by an individual.

18. *Job Performance Requirements* – The knowledge and tasks required of people employed in a job, including the associated competencies and standards of performance.

19. *Lesson Plan* – A detailed teaching breakdown of the important points of a lesson arranged in the order in which they are to be presented. A lesson plan is a step by step analysis of how one intends to develop a lesson.

20. *Management Strategies* – Methods of organizing and manipulating instructional facilities, equipment, materials, students and time.

21. *Module* – A natural subdivision of a group of tasks or competencies and composed of lessons that would logically be taught in close sequence.

22. *Occupational Analysis* – A list of all the job tasks and all the related technical knowledge needed to function successfully in a given occupation.

23. *Perceptual Domain* – A non-documented area in the classification of objectives. The perceptual domain includes objectives that refer to utilizing the senses in analyzing and diagnosing problem situations.

24. *Performance Objective* – Same as a behavioral objective.

25. *Psychomotor Domain* – An area in the classification of objectives. The psychomotor domain includes those objectives concerned with skills in the manipulation of materials and objects.

26. *Related Instructional Content* – (Related Technical Knowledge) – The information and understandings that a worker needs which are related to the manipulative tasks of the occupation.

27. *Rotation* – A process employed by a teacher which assures that all students have the opportunity to develop skills and gain experience in all phases of an educational program on an organized basis.

28. *Scope* – The depth and breadth of the tasks and instructional content to be taught in a particular course.

29. *Sequencing* – The process of arranging the instructional content into the most appropriate order for efficient and effective learning.

30. *Skill* – (Operation) – A manipulative action performed while producing a finished product.

31. *Step* – A level within the hierarchy of a job, i.e., Job-Task-*Step*-Activity.

32. *Summative Evaluation* – An appraisal process designed to determine the degree of accomplishment or achievement on the part of the student in relation to the behavioral objective(s).

33. *Task* – (Skill or Occupation) – A unit of work performed in the completion of an assigned job, i.e., Job-*Task*-Step-Activity.

34. *Task Analysis* – (Occupational Analysis) – A specific and exact examination of the units of work in a task.

35. *Teaching Strategies* – Methods of directing and conducting the process of instruction in a given situation.

Sample task list (partial)

Read each task statement carefully.
Circle the appropriate number under each heading for each task you perform.
Write in the blank spaces, at the end of each section, other tasks you perform that are not listed in the inventory.

	Frequency				Criticality				Location of training	
	Several times a day	Once a day or several times a week	Once a week or several times a month	Once a month or less	Flexible	Average	Above average	Highly critical	On the job training	Classroom training
Clinical Procedures										
51. Sterilize instruments with boiling water	1	2	3	4	1	2	3	4	1	2
52. Sterilize instruments with chemicals	1	2	3	4	1	2	3	4	1	2
53. Clean chemical sterilizing equipment	1	2	3	4	1	2	3	4	1	2
54. Clean autoclave	1	2	3	4	1	2	3	4	1	2
55. Prepare and autoclave gauze sponges	1	2	3	4	1	2	3	4	1	2
56. Fold and autoclave towels	1	2	3	4	1	2	3	4	1	2
57. Wash and wrap surgical glove	1	2	3	4	1	2	3	4	1	2
58. Autoclave surgical gloves	1	2	3	4	1	2	3	4	1	2
59. Prepare and wrap instruments	1	2	3	4	1	2	3	4	1	2
60. Autoclave instruments	1	2	3	4	1	2	3	4	1	2
61. Prepare and wrap glass syringes and needles	1	2	3	4	1	2	3	4	1	2
62. Autoclave syringes and needles	1	2	3	4	1	2	3	4	1	2
63. Determine and chart height of patient	1	2	3	4	1	2	3	4	1	2
64. Determine and chart weight of patient	1	2	3	4	1	2	3	4	1	2

Sample task list (partial)

Read each task statement carefully.
Circle the appropriate number under each heading for each task you perform.
Write in the blank spaces, at the end of each section, other tasks you perform that are not listed in the inventory.

	Frequency				Criticality				Location of training	
	Several times a day	Once a day or several times a week	Once a week or several times a month	Once a month or less	Flexible	Average	Above average	Highly critical	On the job training	Classroom training
65. Take and chart a temperature	1	2	3	4	1	2	3	4	1	2
66. Take and chart a pulse	1	2	3	4	1	2	3	4	1	2
67. Count and chart respiration of patient	1	2	3	4	1	2	3	4	1	2
68. Take and chart a blood pressure	1	2	3	4	1	2	3	4	1	2
69. Determine color vision with Ishihara charts	1	2	3	4	1	2	3	4	1	2
70. Measure patient's vision with Snellen chart and record findings	1	2	3	4	1	2	3	4	1	2
71. Apply a circular bandage	1	2	3	4	1	2	3	4	1	2
72. Apply a finger splint	1	2	3	4	1	2	3	4	1	2
73. Apply a figure-of-eight bandage	1	2	3	4	1	2	3	4	1	2
74. Apply a recurrent-turn bandage	1	2	3	4	1	2	3	4	1	2
75. Apply a spiral reverse flip bandage	1	2	3	4	1	2	3	4	1	2
76. Apply elastic bandage	1	2	3	4	1	2	3	4	1	2
77. Apply an arm splint	1	2	3	4	1	2	3	4	1	2
78. Apply an arm sling	1	2	3	4	1	2	3	4	1	2